SERVICE MANUAL

AVU

P28-AUV-2

Dual Trace Oscilloscope, Ballantine 1066B

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General Information

The 1066B general purpose oscilloscope is a solid state, portable, dual trace oscilloscope suitable for a diverse number of laboratory and television applications. DC mode bandwidth at the –3 dB points is DC to 20 MHz, and AC mode bandwidth is 2 Hz to 20 MHz.

Sensitivity from 5 mV/cm to 20 V/cm is covered in 12 switched ranges with a common variable overlap control effective on all ranges. The sensitivity can be increased to 1 mV/cm by connecting the Y1 and Y2 channels in cascade.

Several display modes are incorporated: CH1 or CH2 single trace; CH1 and CH2 dual trace with alternate sweep or 250 kHz chopped and automatically selected by the setting of the timebase switch; X – Y in which the precision attenuators in one Y channel are utilised to control the amplitude of the X signal. $Y_1 + Y_2$ (algebraic addition) or $Y_1 - Y_2$ facilities are also available.

Sweep speeds from 1 S/cm to 0.5 μS/cm are covered in 20 switched ranges with a common variable overlap control effective on all ranges A X 10 magnifier is incorporated so that the sweep speed can be increased to 50 ns/cm.

Switch selected trigger sources are, internal from either one of the two Y channels, external via a front-panel connector, and the AC supply. A facility for triggering from television signals is also incorporated.

Level control may be effected manually or automatically. In the absence of trigger signals in the 'Auto' mode, the time-base switches to an automatic free run condition and produces a bright line trace.

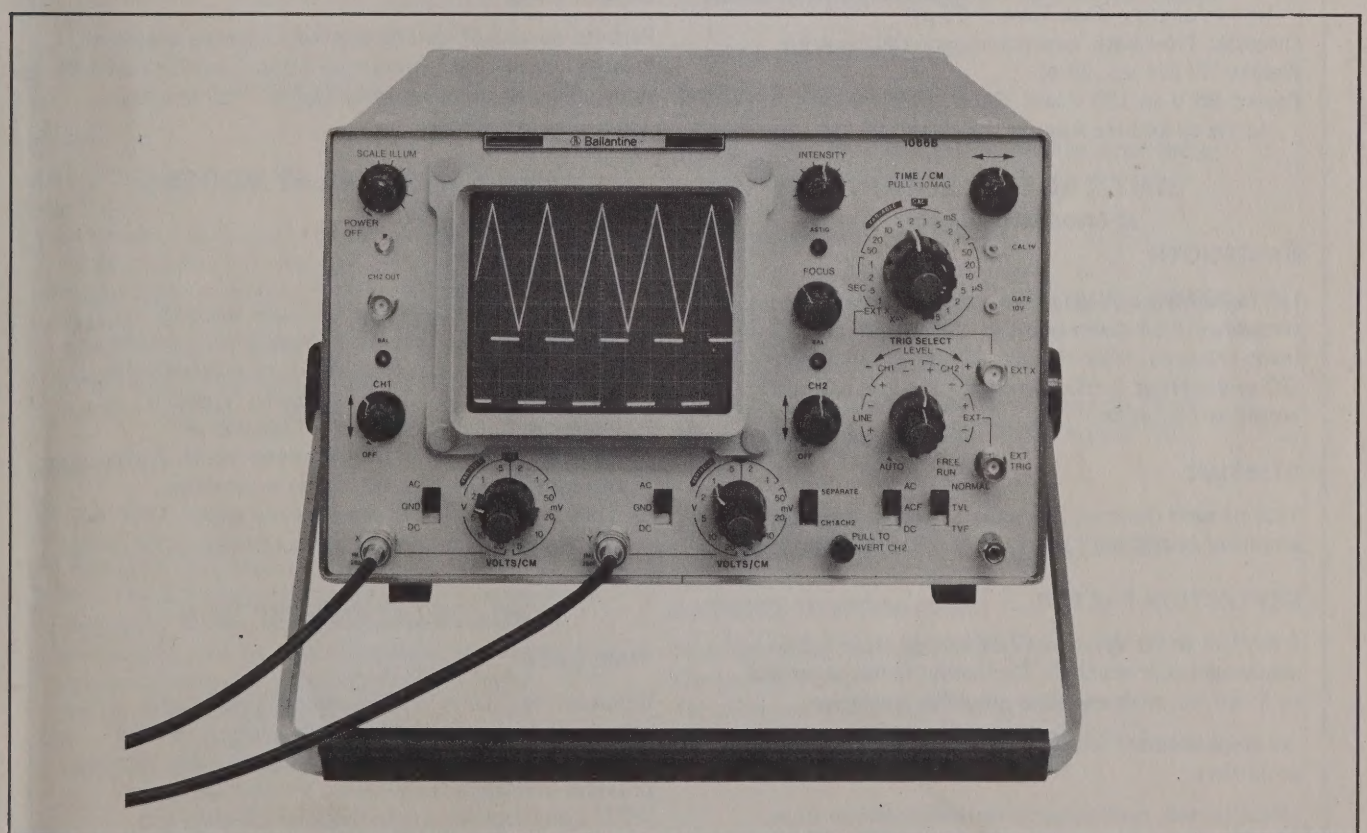


Figure 1-1. Ballantine 1066B Oscilloscope

Section 2

Specifications

CHARACTERISTIC SUMMARY

VERTICAL *(2 Identical Channels)*

Bandwidth: DC to 20 MHz
Risetime: 17.5 ns
Calibrated Deflection Factor: 5 mV/cm to 20 V/cm
Input RC: 1 megohm paralleled by 28 pF
High Sensitivity: 1 mV/cm, DC to 5 MHz

HORIZONTAL

Calibrated Time Base: 0.5 μs/cm to 1 s/cm
X10 Magnifier: Extends fastest time-base to 0.05 μs/cm
External Input: 80 mV/cm DC to 2 MHz
X-Y Operation: Via Y1 and Y2 input channels, 5 mV/cm

CRT

Display Area: 8 x 10 cm
Accellerating Voltage: 4 kV
Phosphor: P31 standard (P7 optional)

GENERAL

Amplitude Calibrator: 1 volt p-p, front panel jack, line frequency. Rise Time ≈ 30 μs.
Outputs: Time base, sweep and gate. CH2 output
Weight: 19 3/4 lbs. (9kg)
Power: 95 V to 130 V and 190 V to 260 V, 45 Hz to 440 Hz Approx. 28 watts (35 va)

VERTICAL DEFLECTION

(2 Identical Channels)

BANDWIDTH

DC to 20 MHz at 3 dB down (each channel);Low-frequency 3 dB down point in <2 Hz with ac coupling (each channel), <0.2 Hz with 10x attenuator probe; DC to 5 MHz at 3 dB down, for 1 mV/cm cascaded amplifier operation.

RISETIME

17.5 ns each channel; 70 ns for 1 mV/cm cascaded amplifier operation.

DEFLECTION FACTOR

5 mV/cm to 20 V/cm in 12 calibrated steps 1-2-5 sequence (each channel). Deflection factor extended to 1 mV/cm with cascaded amplifier operation.

All steps accurate within 3%; 5% accuracy of cascaded amplifiers.

Uncalibrated, continuously variable between steps. Vernier range >2.5:1 extends sensitivity to <50 V/cm.

DC DRIFT

Drift with time: (2 channels 5 mV to 20 V/cm)
Short term: (Ambient temperature and constant line voltage) 1 mm or less during any minute within first hour after 30 minute warmup.
Long term: (With constant ambient temperature in range of 20°C to 30°C and constant line voltage) 2 mm or less during first hour after 30 minute warmup.

Drift with temperature: 4 mm or less per 10°C.

INPUT RC

1 megohm ± 2% paralleled by approximately 28 pF via DC/Ground/AC slide switch

MAXIMUM INPUT VOLTAGE

DC coupled ± 400 V (DC plus peak AC). AC coupled not to exceed ± 500 V (DC plus peak AC)
Maximum AC input is 500 V p-p at 1 kHz or less.

DELAY LINE

Permits viewing of leading edge of triggering waveform. Printed circuit type introducing a nondistorting balanced signal delay of approximately 150 ns. Visible delay approximately 40 ns.

OPERATING DISPLAY MODES

1) Channel 1 only
2) Channel 2 only
3) Channels 2 and CH1 cascaded
4) Dual Trace Display: chopped mode selected automatically on time base ranges from 1 ms/cm to 1 s/cm inclusive and alternate display mode from 0.5 ms/cm to 0.5 μs/cm. Successive 3 μsec segments of each channel are displayed at approximately 500 kHz in chopped mode. Z axis blanking of switching transients is provided.
5) Added: CH1 and CH2 algebraically added. CH2 may be inverted for difference measurements (CH1-CH2).

HORIZONTAL DEFLECTION

TIME BASE

0.5 μs/cm to 1 s/cm in 20 calibrated steps (1-2-5 sequence) accurate within 3% over centered 8 cm of CRT scale. Uncalibrated continuously variable vernier provides overlap between steps. Vernier has range >2.5:1 and extends sweep range to 2.5 s/cm and 25 seconds full scale.

X10 MAGNIFIER

Operates over full time base and increases fastest range to 50 ns/cm. Accuracy of magnified time base is within 5% over centered 8 cm of CRT scale. Magnifier permits full screen 10 cm display of any one cm section of the normal (x1) time base. Magnifier expands normal (x1) time base around center of scale (± 1.5 cm).

X-Y OPERATING MODE

Operation via CH1 and CH2 inputs
Deflection factor (both amplifiers) 5 mV/cm to 20 V/cm in 12 steps. Uncalibrated vernier provides overlap and extends sensitivity to < 50 V/cm. (X10 Magnifier inoperative) Accuracy within 3%
Bandwidth – DC to 1 MHz at 3 dB down; AC coupled 2 Hz to 1 MHz at 3 dB down.
Phase shift – < 1° from DC to 50 kHz: < 3° DC to 500 kHz (5 mV/cm deflection factor)

EXTERNAL X INPUT

Variable in two steps from approximately 80 mV/cm to 0.8 V/cm with operation of the PULL X10 magnifier.
Bandwidth DC to 2 MHz
Input RC 100 kΩ ± 10% paralleled by less than 38 pF.

TRIGGER

MODES

Normal Trigger
Free Run
Auto Trigger – Automatic operation from 40 Hz to 2 MHz and useful beyond 20 MHz. Minimizes trigger adjustment for signals of different amplitudes, shapes, and repetition rates. With no input (or input less than 40 Hz), the automatic triggering free runs the sweep and provides a bright baseline reference trace at all sweep rates.

COUPLING

DC
AC
AC fast (Low Frequency Reject)
TVF – TV coupling optimizes frame rate triggering of the sweep. An active TV sync stripper circuit is provided to remove video signal modulation from composite video signals and permit optimum triggering of the time base at TV frame rates.
TVL – TV coupling optimizes TV line triggering of the sweep thru active sync stripper.

SOURCES

Internal: CH1 + trigger polarity
CH1 – trigger polarity
CH2 + trigger polarity
CH2 – trigger polarity
External: + trigger polarity
– trigger polarity
Line: + trigger polarity
– trigger polarity

REQUIREMENTS

Trigger Sensitivity – Manual
DC (Internal) 2 mm DC to 2 MHz increasing to 1 cm at 20 MHz
DC (External) 300 mV p-p DC to 2 MHz increasing to 1.5V rms at 20 MHz
AC (Internal): 2 mm p-p 10 Hz to 2 MHz increasing to 1.5 V at 2 Hz and 20 MHz
AC (External): 300 mV p-p (110 mV rms) 10 Hz to 2 MHz increasing to 1.5 V p-p (550 mV rms) at 2 Hz and 20 MHz
TVF (Manual Only): Internal 1 cm p-p video
External 1.5 V p-p video
TVL (Manual Only): Internal 1 cm p-p video
External 1.5 V p-p video
ACF: same as AC coupled source above 50 kHz. Requirements increase below 50 kHz (LF Reject)

Trigger Level Control Range

Internal: > 8 cm (± 4 cm)
External: > 20 V (± 10 V)
Manual trigger level control deactivated when using Automatic triggering

Trigger Sensitivity – Automatic

Internal: 2 mm p-p 40 Hz to 2 MHz
External: 300 mV p-p (110 mV rms) 40 Hz to 2 MHz

External Trigger Input RC

100 kΩ ± 10% paralleled by approximately 15 pF
Maximum external input 250 V (DC + peak AC)

ENVIRONMENTAL FEATURES

AMBIENT TEMPERATURE

Non-Operating (storage): –40°C to +75°C
Operating: 0 to 50°C
All stated accuracies apply from 15°C to 30°C. From 0°C to 15°C and from 30°C to 50°C accuracy tolerances widen by ± 2%

HUMIDITY

Constant operation at 40°C and 95% relative humidity. Intermittent operation within the specified temperature range and all humidity conditions which prevent condensation. Operating and storage: 5 cycles (120 hours) at 90% relative humidity referenced to MIL-E-16400 F class III.

ALTITUDE

Operating: 3 km (10,000 ft), without temperature derating
Non-Operating: 15 km (50,000 ft)

VIBRATION

Operating: 15 minutes along each of 3 axes at 0.25 mm (0.010 inches) double amplitude (p-p) displacement (4G limit) 10 to 2000 to 10 c/s in 1 minute cycles.

SHOCK

20 g's, 1/2 sine, 11 ms duration, 2 shocks per axis for a total of 6 shocks

TRANSIT

Unit will meet National Safe Transit when factory packaged. Vibration for one hour at 1.2 G. 76 cm (30 inch) drops on corners, edges and flat surfaces.

OTHER CHARACTERISTICS

AMPLITUDE CALIBRATOR

Square wave, line frequency, 1 V p-p amplitude ± 2% at front panel CAL jack. Positive going from source impedance of 1 kΩ. Risetime approximately 30 μs.

CHANNEL 2 OUTPUT

25 mV/cm of CH2 display. DC coupled or AC coupled 5 Hz to 5 MHz from source impedance of approximately 240 Ω. Maximum output 0.25 V through front panel BNC connector.

GATE OUTPUT

Gate output (on front panel jack) is a positive going rectangular pulse with same duration as time base. Flat top and fast rise time for probe adjustment. Amplitude nominally 10 V from an approximate source impedance of 10 k Ω.

RAMP OUTPUT

Time base frequency ramp available through jack on rear panel. Positive going amplitude nominally 8 V p-p from an approximate source impedance of 6.8 k Ω.

EXTERNAL Z MODULATION

Brightness modulation of CRT
Thru rear panel jack.
AC Coupled thru 0.01 μF capacitor.
Visible modulation at normal trace intensity with input of 2 V p-p.
Blanking voltage 60 V p-p.
Input resistance approximately 1 MΩ.

CRT

5 inch rectangular cathode ray tube. Interchangeable illuminated external graticule with full size 8 x 10 cm display area. 4 k V accellerating potential. P31 phosphor normally supplied. P7 is optional. Removable bezel permits attachment of oscilloscope cameras and viewing hoods as well as removal or interchange of graticules and insertion of RFI mesh filter. CRT power supply operates at low frequency without radiated or conducted electromagnetic interference.

POWER

Line frequency 45 to 440 Hz. May be operated from dc or battery supply thru optional external inverter.
Power nominally 28 watts (approx 35 VA)
Quick change rear panel switch adapts instrument to the following supply voltage ranges; 95 V to 111 V, 103 V to 121 V, 111 V to 130 V, 190 V to 222 V, 206 V to 242 V, 222 V to 260 V.

WEIGHT

19 3/4 lbs (9 kg)
Shipping weight 30 lbs (13 1/2 kg)

DIMENSIONS

Dimensions (Bench)
Case: Height – 178 mm (7 in.)
Width – 285 mm (11.25 in.)
Depth – 394 (15.5 in.); behnind panel 381 mm (15 in.)
Overall: (including knobs, feet and handle width)
Height – 196 mm (7.625 in.)
Width – 318 mm (12.5 in.)
Depth – 437 mm (17.25 in.)

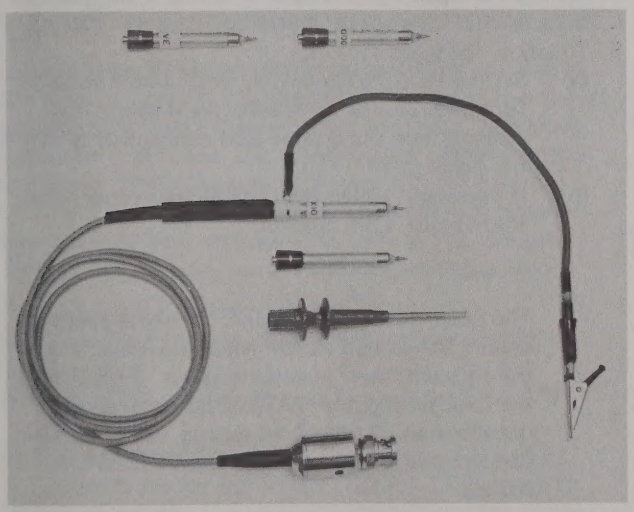
Dimensions (Rack)
Height – 178 mm (7 in.)
Width – 483 mm (19 in.)
Depth – behind panel 381 mm (15 in.)

SUPPLIED ACCESSORIES

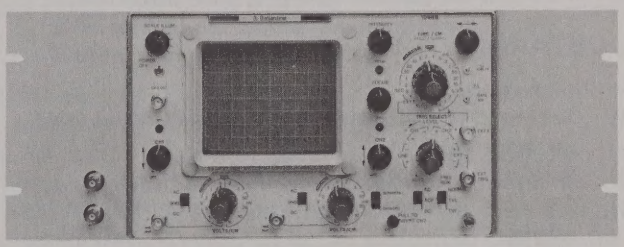
1 each cable BNC-BNC 48 in. (120 cm), 12249D
1 each CRT filter grey for P31 phosphor
1 each CRT filter clear
1 each Instruction Manual
1 each Power Cord

AVAILABLE ACCESSORIES

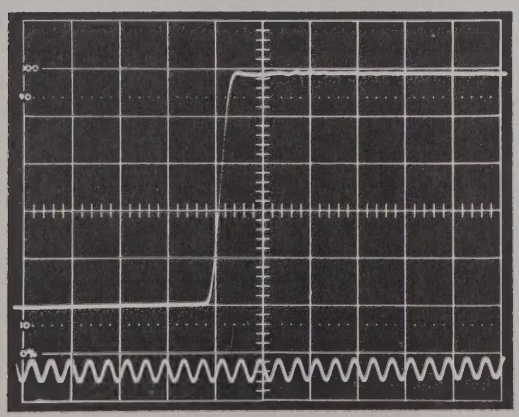
Probe Kit, Attenuator 10:1; 10 MΩ, 11 pF; includes 1:1 adapter	
110 mm (3½ ft.)	10600A/B
150 mm (5 ft.)	10601 A/B
RF Detector head for probe	85100120A
Viewing Hood 8 x 10 cm	10702A
Protective Soft Luggage Style Cover	10725A
Cover, Front Panel	10750A
Calibrator; Amplitude, Time and Rise time	6125A
Electronic Storage Recorder Endless Magnetic Tape loop DC to 100 kHz	7050A/B
Camera, Polaroid	7000A
Camera, Polaroid 8 x 10 Adapter Bevel	36100060A
Rack mount assembly	800-03
with BNC Feedthru connectors	800-02
Cable BNC to BNC 120 mm (48 in.)	12249D
BNC to BNC 22 mm (8 in.)	12249A
BNC to Alligator Clips 120 mm (48 in.)	12250A
Termination, 50 Ω BNC Feedthru	12630A



10600A Probe & Accessories



Rack Mount Assembly



Pulse Response
5 mV/cm Y
50 Ω Termination at scope
Input Pulse $T_R \approx 750$ ps
Internally Triggered — Auto Mode

Timebase
50 MHz Sine Wave Calibration — 50 ns/cm

Section 3

Operation

3-1. SWITCHING ON

CAUTION

The 1066B relies on convection cooling and must always be operated with reasonable air circulation.

1. Set the support/carrying handle to the required operating position. The handle is released by pulling both handle sides outward, and it can then be turned to lock in any one of 5 positions.
2. Ensure that the supply voltage selector on the rear panel is set to suit the voltage of the supply to be used. The selector must not be operated while the instrument is switched on.
3. Turn the GRAT control clockwise beyond the POWER OFF setting and observe that the indicator lamp lights.

3-2. OBTAINING A TRACE

1. To obtain a trace
   (a) Set the CH1 position control to approximately mid setting.
   (b) Set the CH2 control to CH2 OFF.
   (c) Set the X position control to approximately mid setting.
   (d) Set the TRIG/SELECT switch to FREE RUN.
   (e) Set the TIME/CM switch to 5 μs.
   (f) Adjust the INTENSITY control to obtain a display of the required brightness.
   (g) Center the display by adjusting the CH1 and horizontal position control.
   (h) Adjust the FOCUS control to obtain a sharply defined trace.

3-3. SETTING UP Y CHANNELS

1. Connect a signal to the CH1 and CH2 input BNC connectors.
2. For
   (a) Direct connection of the input signal; set the associated input slide switch to DC.
   (b) Capacitive coupling of the input signal through an internal 0.1 μF 400 V capacitor; set the slide switch to AC.

NOTE

When examining low amplitude AC signals superimposed on a high DC level, the slide switch should be set to AC and the sensitivity of the Y amplifier increased as in (4) until the AC signal is displayed.

3. To locate the baseline, set the slide switch to GND. At this setting, the input signal is open circuit and the input of the amplifier is switched to ground.
4. To adjust the sensitivity
   (a) Set the VOLTS/CM switch to a suitable setting. To minimize pick up at sensitive settings, it is essential that the ground lead connection is near to the signal point.
   (b) If necessary, adjust the uncalibrated concentric VARIABLE Gain control.

NOTE

The range of the VARIABLE control is approximately 3:1 so that its full adjustment overlaps the adjacent lower sensitivity range. Except at the CAL setting, the VARIABLE control is uncalibrated. At the CAL setting, the calibration corresponds to the setting of the VOLTS/CM switch.

5. For vertical shift of the trace, adjust the Y position controls (identified with vertical arrows).
6. If, under no signal conditions, trace movement is detected when the setting of the VOLTS/CM switch is altered, reset the BAL preset control.

NOTE

This control will only need adjustment at infrequent intervals. Before adjusting the BAL preset control, however, ensure that the input slide switch is set to the ground setting, and the VARIABLE control on the VOLTS/CM switch is set to CAL.

3-4. SINGLE TRACE AND CASCADE OPERATION

1. For single trace operation on the CH1 set
   (a) The CH1 position control beyond the CH1 OFF setting.
   (b) The CH2 position control (indicated by double ended vertical arrow) to CH2 OFF.
2. For single trace operation on the CH2 channel, set
   (a) The CH2 position control beyond the CH2 OFF setting.
   (b) The CH1 position control (indicated by double ended vertical arrow) to CH1 OFF.
3. A high sensitivity (1 mV/cm) single trace condition with a bandwidth of DC to 5 MHz is possible by series operation (cascade) of both CH1 and CH2:
   Set
   (a) Both input slide switched to DC
   (b) Both CH1 and CH2 VOLTS/CM switches to 5 mV.
   (c) CH1 position control beyond the OFF CH2 setting and use as vertical position control.
   (d) CH2 position control to CH2 OFF.
   (e) Connect the CH2 OUT BNC to the CH1 input BNC by means of the short BNC coaxial cable (12249A).
   (f) Connect the input signal to the CH2 input BNC.
   (g) AC operation (2Hz to 5MHz) can be obtained by switching the CH2 coupling switch to AC.

3-5. DUAL TRACE OPERATION

In the dual trace condition, the beam switching function is in operation and results in independent display of two signals simultaneously. Two modes of beam switching – chopped and alternate – are used, and automatically selected by the setting of the TIME/CM switch. At any fast setting from 0.5 μs to 0.5 ms, inclusive, the alternate switching mode is in operation. At slow settings from 1 ms to 1 S, inclusive the EXT X, the chopped switching mode is in operation.

1. For dual trace operation, set
   (a) The CH1 position control beyond the CH2 OFF position.
   (b) The CH2 position control beyond the CH2 OFF position.
2. (a) To algebraically add the CH1 display to the CH2 display set the SEPARATE/CH1 + CH2 switch to CH1 + CH2.
   (b) To algebraically subtract CH2 display from CH1 display pull the PULL TO INV CH2 knob. The common mode rejection obtained can be maximized by careful adjustment of either CH1 or CH2 VARIABLE control to exactly equalize channel sensitivities. This invert facility of CH2 can also be used with the CH1 and CH2 channels separated for such applications as the comparison of two signals, one the inverse of the other.

3-6. TIMEBASE AND X AMPLIFIER

The speed of the internal timebase (i.e. the time scale of the horizontal axis) is determined by the setting of the TIME/CM switch. As explained in section 3-5, the setting of the switch automatically determines which mode of beam switching is used during dual trace operation. In addition to selection of the speed of the internal timebase, the switch has two functional settings, EXT X and X-Y, at which the internal timebase is inoperative. The gain of the internal X amplifier may be increased X10 by pulling out the PULL X10 control on the VARIABLE TIME/CM switch. This facility is available at all settings except X-Y of the TIME/CM switch. The expansion effectively increases the sweep length from 10 cm to 100 cm and thus allows close examination of any section of the trace. Any portion of the increased sweep length may be selected for viewing on the display by adjusting the X position control.

When the TIME/CM switch is set to X-Y, the CH1 input BNC is switch to the X amplifier. Under this condition, an external signal applied to the X(CH1) connector routed through the input attenuators in the CH1, and the full range of sensitivity and attenuators may be utilized to obtain a calibrated horizontal deflection. Only single trace operation (CH2) is possible. Phase shift is less than 3° up to 500 kHz and the bandwidth is 1 MHz. In this mode, the CH1 position control is inoperative and X position is effected by the X position control.

3-6a. INTERNAL TIMEBASE

1. To adjust the time scale of the horizontal axis
   (a) Set the TIME/CM switch to a suitable setting.
   (b) If necessary, adjust the concentric uncalibrated VARIABLE control.

NOTE

The range of the VARIABLE control is approximately 3:1. Except at the CAL setting, the VARIABLE control is uncalibrated. At the CAL setting, the calibration corresponds to the setting of the TIME/CM switch.

2. If close examination of any portion of the trace is required, operate the PULL X10 control.
3. For horizontal shift of the trace, adjust the X position control (identified by horizontal arrow). The control has a dual speed (backlash) function. Initial operation provides coarse speed control, the return adjustment provides fine speed control.

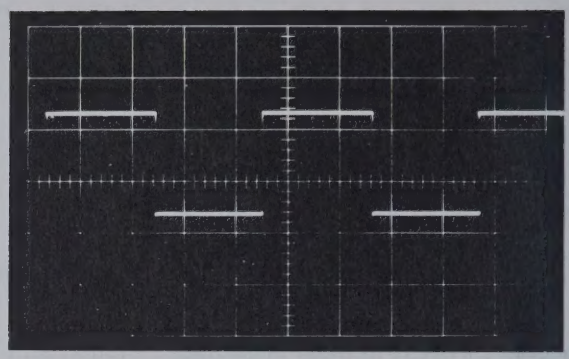
3-6b. EXTERNAL X INPUT

In this condition, the external signal is applied directly to the internal X amplifier to product uncalibrated (approximately 0.8 V/cm) horizontal deflection. Dual trace Y operation may be used to display two different Y input signals against EXT X input. This provides capability to use the 1066B as an indicator for sweep signal generator measurements where the generator output (or test circuit input) may be displayed on CH1 and the swept output signal from the circuit under test may be viewed thru CH2. This permits comparison of input vs. output in measurements using sweepers. Bandwidth is DC to 2 MHz.

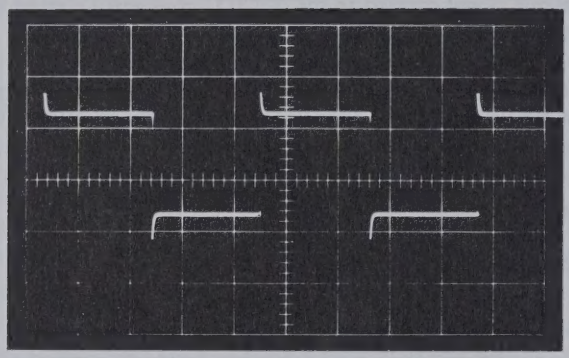
1. Set the TIME/CM switch to EXT X.
2. Connect the external signal to the EXT X BNC connector.

PROBE COMPENSATION

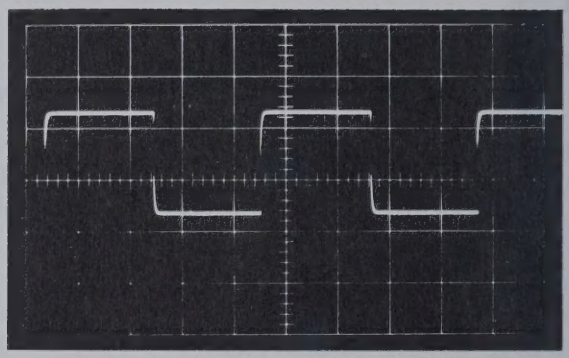
Using CAL 1 V jack on panel
0.5 V/cm Y
5 ms/cm X



Proper Adjustment of Probe Compensating Capacitor

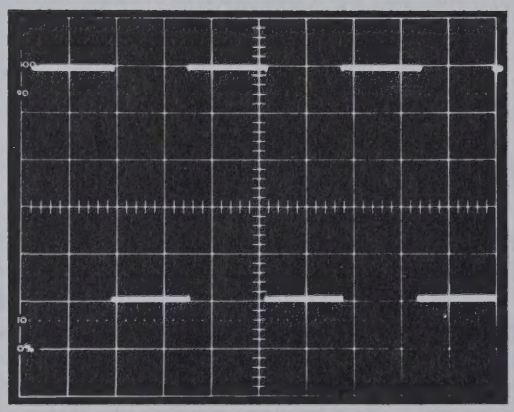


Over Compensated



Under Compensated

Figure 3-1. Probe Compensation



Amplitude/Sensitivity Calibration

Direct input to dc coupled input of amplifiers
Attenuators set at 200 mV/cm

Line Frequency Square Wave from Cal 1 V jack on panel
200 mV/cm Y
5 ms/cm X

Figure 3-2. Amplitude/Sensitivity Calibration

3-7. X-Y MODE

1. Set the TIME/CM switch to X-Y.
2. Set the CH1 input slide switch to DC or AC.
3. Connect the external signal which is to be used for X deflection to the X (CH1) BNC.
4. Operate the CH2 as for single trace operation and use the CH1 VOLTS/CM switch to control the X deflection.

3-8. TRIGGER

The timebase may be operated in a free run condition or triggered from the positive or negative slope of a signal as determined by the setting of the TRIG SELECT switch. The triggering sources selected by the TRIG SELECT switch are as follows:

(a) The line input frequency derived from the transformer in the power supply section.
(b) CH1 and CH2 amplifiers (irrespective of which beam is displayed).
(c) An external triggering source connected to the EXT TRIG BNC connector.

The LEVEL control, concentric with the TRIG SELECT switch allows selection of the triggering point on the trigger waveform and hence determination of the start of the horizontal trace. When the LEVEL control is set to AUTO, the trigger circuit automatically biases itself to the most sensitive trigger level condition, and AC couples the trigger signal. In the absence of a trigger signal (in auto mode) the timebase will free run and maintain a sweep display at the selected TIME per cm.

the TRIG SELECT switch is used in conjunction with the AC/ACF/DC and the NORM/TVL/TVF slide switches.

To trigger from conventional signals select NORM on the NORM/TVL/TVF switch. The AC/ACF/DC switch selects the trigger signal coupling.

AC The AC coupled wideband mode used for most common trigger signals.
ACF A filter is switched into circuit to reject low frequencies. High frequency triggering may be effected from complex waveforms such as a high frequency signal with low frequency ripple content.
DC The trigger signal is DC coupled enabling the timebase to be triggered from very low frequency waveforms or consistently triggered from variable duty cycle (mark/space) waveforms.

To trigger from TV video signals select either TVL or TVF. In the TV modes the AC/ACF/DC coupling options are still retained but ACF should not be used in this mode.

TVL A television sync. separator is switched into circuit so that the timebase can be triggered from the line pulses of a complex TV signal.
TVF The sync. separator remains in circuit but the line pulses are integrated. The timebase triggers on the remaining frame pulses.

Triggering control is effected as follows:

1. If required, connect the external trigger signal to the EXT TRIG connector.
2. Set the AC/ACF/DC and NORM/TVL/TVF switches to the required setting.
3. Set the TRIG SELECT switch to select the required trigger signal.
4. Adjust the LEVEL control so that the trace starts at the required point on the waveform.
5. If the amplitude of the trigger signal is low, the setting of the LEVEL control may become critical. Under this condition it is recommended that the LEVEL control be set to AUTO.
6. If a triggered timebase condition is not required, set the TRIG SELECT switch to FREE RUN.

NOTE

If, in the Auto mode, frequency of the trigger is less than 40 Hz or the amplitude is too low for reliable triggering, the timebase automatically changes to a free run condition. This condition produces a bright line at the selected sweep speed.

3-9. ADDITIONAL FACILITIES

3-9a. USE OF OPTIONAL ATTENUATOR — BALLANTINE 10600 SERIES

A X10 passive probe may be used to extend the voltage range and increase the input impedance of the Y amplifiers. The input resistance of a Y channel is 1 MΩ, chunted by approximately 28 pF. The effective capacity of the input lead must be added to this and the resultant impedance can often load the signal source. Therefore it is advisable to use the 10 MΩ X10 probe, 10601A. This reduces the input capacity and increases the input resistance, at the expense of the sensitivity. The probe contains a shunt RC network in series with the input and forms an attenuator with the input RC of the Y channel. To obtain a flat frequency response it is necessary to adjust the capacitance of the probe to match the input capacity of the Y channel as follows:

1. Set the Y channel VOLTS/CM switch to 0.02 V, and the TIME/CM switch to 5 ms.
2. Connect the probe to the CAL 1V. Adjust the probe compensating capacitor for level response with no overshoot or undershoot visible in the display. (See Fig. 3-1)

3-9b. CAL 1V

This connector provides a DC coupled positive-going square wave of 1 V ±2% amplitude at line frequency for calibration checks. The square wave has a source impedance of 1 kΩ and a rise time of approximately 20 uS. Time base may be checked for calibration by observing 3 cycles at 60 Hz power line and 2 1/2 cycles at 50 Hz power line when the TIME/CM switch is set to 5 mS/cm. (See Fig. 3-2)

3-9c. GATE 10V

This connector provides a DC coupled positive-going square pulse of 10 V amplutide from 10 kΩ source impedance. The duration of the pulse is coincident with the duration of the timebase sweep and may also be used to compensate a passive probe.

3-9d. SWEEP RAMP

This connector on the rear panel provides a DC coupled positive-going timing ramp of approximately 8 V amplitude generated by the timebase. Source impedance is 6.8 kΩ and the ramp may be used as a drive for external frequency swept oscillators etc., to allow display of voltage against frequency.

3-9e. Z MODULATION

This connector on the rear panel allows an AC coupled pulse for blanking to be applied to the tube. Coupling is by internal 0.01 μF capacitor into 1 MΩ input resistance.

Used in conjunction with the INT EXT switch is required amplitude of input pulse for

(a) Blanking is approximately 2 V p to p for visible modulation at normal brightness.
(b) Full blanking is 60 V negative going.

3-9f. INT/EXT SLIDE SWITCH FOR Z MOD SELECTION

A camera may be attached to the oscilloscope to record waveforms. This facility is particularly useful for the slow speed timebase settings. The Ballantine 7000A polaroid camera is recommended with 8 X 10 cm Bezel, Ballantine 36100060A.

3-9h. ELECTRONIC STORAGE

To obtain "storage" display operation Ballantine provides the 7050A endless magnetic loop tape recorder. Transients are readily recorded and displayed electrical recall and delayed sweep expansion is possible for window of 20 ms and risetime of 3.5 μsec.

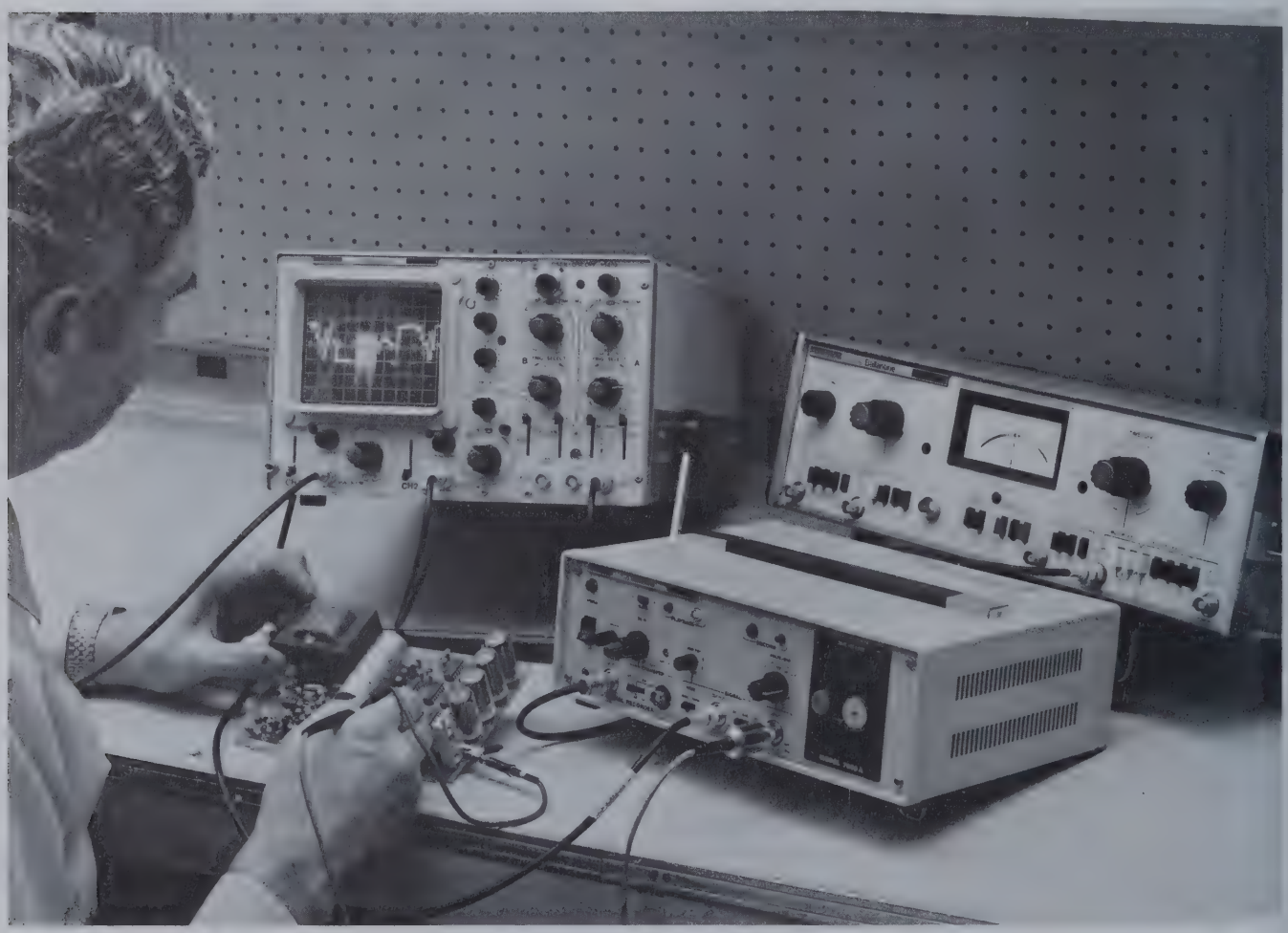


Figure 3-3. Typical Setup Using 7050A Electronic Signal Recorder

Principles of Operation

4-1. GENERAL

The 1066B is shown in block diagram form in Fig. 4. Circuit details and interconnection of printed circuit boards are shown on the following diagrams.

Fig. 5 Y—Channel Attenuator and Input Amplifier
Fig. 6 'Y' Amplifier and Trigger Circuits
Fig. 7 Timebase and X Amplifier
Fig. 8 Beam Switching and Y Output Amplifier
Fig. 9 Power Supplies and Tube Network
Fig.10 Interconnection of Printed Circuit Boards

4-2. INPUT CIRCUIT OF Y AMPLIFIERS

NOTE

The Attenuator, Input Amplifier and Pre-amplifier in the CH1 are identical to those in the CH2. Accordingly, only CH1 is described.

The input signal is applied to the front-panel BNC SKA (Fig.5) and then to the 3-position slide switch S1. The switch selects AC or DC input coupling by including or bypassing C1 in the signal path. In the third position of the switch, the input socket is disconnected and the input of the attenuator is connected to ground through R2.

Each of the two sections of the CH1 Attenuator feed into an input impedance of 1 MΩ. The attenuation of the first section is determined by the potential divider action of R101 and R102. With the input impedance of the second section in parallel with R102, the effective resistance ratio is

$$\frac{10\ k\Omega}{1000\ k\Omega} \quad \text{i.e.} \div 100.$$

Similarly, R103 and R104 in the second section together with the 1 MΩ input impedance of the Input Amplifier introduce a ÷ 10 attenuation. Each section of the Attenuator is frequency compensated by trimmer capacitors (see Table 2) to equalize the high frequency attenuation ratio and to ensure that the input capacity remains the same at each section of the attenuator. In the first section, trimmer capacitor C101 controls the high frequency ratio. The parallel combination of trimmer, C102, and its padder, C108, determines the input capacitance. In the second section, trimmer capacitor, C103, controls the high frequency ratio. The parallel combination of trimmer, C104, and its padder, C109, determines the input capacitance. The way in which the attenuation of the two sections is combined with changes in gain of the CH1 Pre-amplifier is explained on this page.

The output of the second section is applied to the high input impedance CH1 Input Amplifier which has a signal gain of unity. Input resistance is 1 MΩ, and the input capacitance is determined by adjustment of C105. The CH1 Input Amplifier contains two matched field effect transistors, TR101 and TR102. Diodes, D101, D102, D103 and D104, provide overload protection for TR101. Transistor, TR102, is for thermal compensation. Preset resistor, R5, in the TR102 stage is the BAL CH1 control accessible from the front panel. This control is adjusted to eliminate any trace movement when the setting of the CH1 VOLTS/CM switch is altered. Any output from TR102 is due to thermal changes, and this output together with the signal output + thermal signal from TR101 is applied to the gain switching long tail pair configuration of TR201 and TR202 in the CH1 Pre-amplifier shown on Fig. 6.

Neutralizing capacitors, C202 and C203, reduce the loading effect of the CH1 Pre-amplifier on the field effect transistor in the CH1 Input Amplifier

Two methods of varying the $\frac{Rc}{Re}$ gain ratio are incorporated in the long tail pair stage of TR201 and TR202.

Potentiometers, R11, is the VARIABLE control concentric with the front-panel CH1 VOLTS/CM switch and varies the resistance of the emitter circuit. Full adjustment of the control introduces a 3:1 gain variation.

Switch wafer, S2CF, part of the front-panel CH1 VOLTS/CM switch, varies the resistance of the collector circuit to give gains of 1, 2 and 4.

The resistors switched in the collector circuit for the three gains are listed in Table 1.

Table 1. Gain Resistors in the CH1 Pre-amplifier

Gain	Resistors
1	Series arm of R209 and R212 in parallel with series arm of R218 and R220
2	Series arm of R208 and R212 in parallel with series arm of R218 and R220
4	R218 in series with R220

Zener diode, D201, stabilizes the supply voltage to the collector circuit of the differential amplifier.

The overall effect of the two sections of attenuation, and the gains of the CH1 Pre-amplifier are cross referenced in Table 2 to the settings of the CH1 VOLTS/CM switch.

NOTE

Any settings of the switch where a section of the Attenuator may be out of circuit are indicated by ÷ 1.

Table 2. Attenuation and Gain of CH1

Switch Setting	1st Section Attenuator	2nd Section Attenuator	CH1 Pre-amplifier Gain
5m V	÷1	÷1	4
10 mV	÷1	÷1	2
20 mV	÷1	÷1	1
50 mV	÷1	÷10 (C103 (C104	4
0.1V	÷1	÷10 (C103 (C104	2
0.2V	÷1	÷10 (C103 (C104	1
0.5V	÷100 (C101 (C102	÷1	4
1V	÷100 (C101 (C102	÷1	2
2V	÷100 (C101 (C102	÷1	1
5V	÷100 (C101 (C102	÷10 (C103 (C104	4
10V	÷100 (C101 (C102	÷10 (C103 (C104	2
20V	÷100 (C101 (C102	÷10 (C103 (C104	1

Full variation of R11 ensures that any adjacent lower sensitivity range can be overlapped. High frequency compensation of R11 is effected by trimmer capacitor, C211, and high frequency compensation of the switched gain is effected by trimmer capacitors, C209, C210 (with padder C243), and fixed capacitor, C241.

The outputs of the gain switching differential amplifier are applied to emitter followers, TR205 and TR206, which act as buffers to prevent loading of the gain switching circuit by subsequent stages. The slider of potentiometer, R13, in the emitter circuit is fed with −15V so that adjustment of the potentiometer introduces a DC level shift for the CH1 signal. In Y2 channel, S15 a and b inserted between the bases of TR230, TR231 and the position control, acts as a Channel Invert switch.

Two outputs are taken from each emitter circuit. One pair of outputs is fed via transistors, T228, TR229, and TR209, TR210. The gain of TR209, TR210 is preset by R242, determining the gain of the CH1 channel. High frequency compensation is effected by trimmer, C217. The other pair of outputs are applied to the CH1 Trigger Amplifier TR215 and TR216.

4-3. CHANNEL SWITCH

The Channel Switch shown in Fig. 6 contains eight diodes, D203 to D210, inclusive. The switch is supplied with the output signals from the CH1 and CH2 Pre-amplifiers and is operated by signals applied in push-pull to L1 and L2 from the Channel Switch Bistable. Thus, when L1 is positive L2 is negative, and under this condition diodes, D208 and D209, conduct but diodes, D203 and D205, are cut off. As a result, the balanced output of the CH1 Pre-amplifier is applied via diodes, D204 and D206, to the Buffer Amplifier. Because diodes, D208 and D209 are conducting; diodes, D207 and D210, are cut off and any output from the Y2 Pre-amplifier is disconnected from the Buffer Amplifier. When the phase of the outputs from the Channel Switch Bistable reverses, the electrical condition of the Channel Switch changes and the output signal from the Y2 Pre-amplifier is applied to the Buffer Amplifier while the output signal of the Y1 Pre-amplifier is disconnected. The overall result is that on dual trace operation the switched input to the Buffer Amplifier consists of successive alternate periods of CH1 and CH2 signals. The switching rate is determined by the setting of the TIME/CM switch as explained later.

4-4. BUFFER AMPLIFIER

The Buffer Amplifier shown in Fig. 6 consists of TR213 and TR214 operating as feedback stages. The output resistance of this stage plus the 62 Ω resistors, R251 and R255, form the drive resistance for the balanced 150 ns Delay Line connected between pin 24 and pin 25. In the CH1 + CH2 mode the junction of R253 and R252 (pin 59) is connected to −15V through S14A. This subtracts the necessary bias current when Y1 and Y2 channel are added.

4-5. CH1 TRIGGER AMPLIFIER

The CH1 Trigger Amplifier shown in Fig. 6 contains transistors, TR215 and TR216, which operate in a differential amplifier configuration fed with the push-pull input signals from the CH1 Pre-amplifier. The output from the collector of TR216 is fed to the X−Y connection on the TIME/CM switch. This X−Y facility allows an X input to be connected via the CH1 input BNC on the front panel. Capacitor, C245, in the collector circuit of TR216 compensates for phase difference between the X and Y channels in the X−Y mode.

The output from the collector of TR215 is applied to the TRIG SELECT switch, S5, on the front panel.

The preset R313 is set with CH1 trace in center of gradicule to give a zero volt output from the internal trigger amplifier (pin 35) CH1 being selected on the Trigger Selector switch.

4-6. CH2 TRIGGER AMPLIFIER

The CH2 Trigger Amplifier shown in Fig. 6 contains transistors, TR217 and TR218, which operate as a differential amplifier fed with push-pull input signals from the CH2 Pre-amplifier. The output from the collector of TR218 is routed to the CH2 OUT BNC SKD on the front panel.

R262 is set to give a zero volt CH2 output with CH2 OFF.

The output from the collector of TR217 is applied to the TRIG SELECT switch, S5, on the front panel.

4-7. TRIGGER SELECTOR SWITCH

The trigger selector switch has 9 settings as follows:

LINE	+ or –
Y1	+ or –
Y2	+ or –
EXT	+ or –
FREE RUN	+ or –

On wafer, S5AB, four positions corresponding to the + and – functions of CH1 and CH2 are utilized to allow a common amplifier for CH1 and CH2 signals to be switched into circuit. This amplifier, shown in Fig. 6, contains transistor, TR219, which operates in a common emitter configuration with negative feedback. The output of the common amplifier is connected via D229 to wafer, AF, of S5 together with a supply line frequency derived from a winding on power supply transformer, T1, and an external trigger connection applied from the front-panel EXT TRIG BNC SKC via the RC network of R15 and C7. The network has two functions: it attenuates the input level of the external trigger signal and, in conjunction with D212, protects TR220 against over voltage applied to SKC. Two other wafers, BF and BB of S5 are integral with the operation of the Trigger Amplifier and are discussed in paragraph 4-8.

The wiper of S5AF connects the selected trigger source to switch S7, the AC-ACF-DC switch on the front panel. At the AC setting of the switch, the trigger signal is capacitively coupled via C230 to the base of emitter follower, TR220. At the ACF setting, however, C9 and R276 function as an RC Trigger Coupling filter which attenuates low frequencies. In this way, high frequency pulses can be separated from a composite signal for triggering purposes.

When DC is selected by S7, the trigger signal is directly coupled to enable triggering to take place from very low frequency signals. D212 and zener diode, D211, protect TR220 against excessive input drive. In the Trigger mode, the emitter of TR220 is directly coupled through emitter follower, TR227, and the network formed by D222, D225 and D221, to the Trigger Amplifier. S6a is closed causing D222 to conduct and D225 to develop its zener voltage. The cathode of D221 is thus sitting at approximately –3.9V and conducts providing a DC path.

In the AUTO mode, S6a is open, D225 conducts and D222 develops its zener voltage. With its cathode at approximately +3.9V. D221 is reversed biased. The circuit is now AC coupled through C229.

4-8. TRIGGER AMPLIFIER

The Trigger Amplifier shown in Fig. 6 contains transistors, TR222 and TR223, which operate as differential amplifier. The base of TR222 is connected to switch wafer, S5BF, and the base of TR223 is connected to switch wafer, S5BB.

Both switch wafers form part of the front-panel TRIG SELECT switch. Examination of the circuit shows that when the switch is set at any + setting, the signal is applied to the base of TR223, and the base of TR222 is AC coupled to ground via C10. Conversely, when the switch is set at any – setting, the signal is applied to the base of TR222, and the base of TR223 is AC coupled to ground via C10. When the LEVEL control is in use, S6a is closed and the center of the potentiometer sits at about –3.9V R17 can thus be used to trigger the trace on any point of the incoming waveform. A single ended output is taken from the collector of TR223 and applied via diode, D215, to the junction of C236 and R295.

4-9. TELEVISION SYNC. SEPARATOR

A single ended output is taken from the collector of TR222 and fed to a Television Sync. Separator circuit containing transistor, TR227, shown on Fig. 6. The circuit is operative only when S13 is set to TVL or TVF C234 and the base-emitter junction of TR221 selects TV sync. pulses from complex video waveforms even though the picture information may be varying. In the TVL (line) position, amplified sync. pulses are passed from the collector of this transistor through D215 to the Schmitt trigger. When TVF is selected, line pulses are integrated out by the action of C233 and the R282/R283 network. The remaining frame pulses are normally passed on to the Schmitt trigger.

4-10. SCHMITT TRIGGER

The signal applied to the junction of C236 and R295 may be either capacitively coupled (via C236) or DC routed (via R295, S6B and R296) to emitter follower, TR224, shown in Fig. 6. This transistor buffers the input to TR225 which with TR226 operates in a Schmitt trigger configuration. Switch S6, which determines the signal path is ganged to R17, the LEVEL control concentric with the front-panel TRIG SELECT switch. When R17 is set fully counter clock-wise to AUTO, switch, S6B, is open and the output of the Trigger Amplifier is capacitively coupled to TR224. In the AUTO POSITION, S6a is open and the wiper of R17 is at zero volts. As described is paragraph 4-7, the trigger signal is AC coupled to TR222 base. With both input bases at zero volts, TR222 and TR223 form a roughly balanced differential amplifier which passes the trigger signal to the Schmitt trigger at an increased level.

In this condition with no DC level connected from the Trigger Amplifier, the Schmitt Trigger automatically goes into an astable condition which ensures that it is biased to its most sensitive trigger point.

When R17 is turned clock-wise from AUTO, switch, S6, is closed and the output of the Trigger Amplifier is DC routed to TR224. Adjustment of R17 determines the DC level of the base of TR222 or the base of TR223 and in turn, the

level of the output and (because of the output is DC routed to TR224) the time of triggering of the Schmitt. Thus R17 can be adjusted to trigger the trace at any point on the waveform. The function of the Schmitt Trigger is to produce a constant amplitude output pulse whilst the input trigger signal passes the 'window' of the circuit. As previously mentioned, when the LEVEL control is set to AUTO, S6AB, is open and the Schmitt Trigger becomes astable. The time constant is determined by C236 and R305. When the Schmitt Trigger is in the astable mode, any trigger signal coupled via C236 and having a repetition frequency faster than the natural astable frequency automatically locks the Schmitt Trigger to the incoming trigger frequency.

4-11. TIMEBASE GENERATION

Transistors, TR505 and TR508, form the Timebase binary circuit shown in Fig. 7. In the quiescent condition, TR508 is cut off and TR505 conducts. Thus the collector of TR505 is held near to ground potential.

NOTE

To maintain the voltage constant in the quiescent condition at the emitter of TR512 (the output of the timebase) the emitter is included in a negative feedback loop consisting of D515, TR509, D516, D517, TR510 returned to TR512. Thus changes in voltage drops through D516 and D517 due to changes of timing current is compensated by the feedback.

Transistor, TR505, cuts off when the negative-going input trigger is applied to the base from the Schmitt Trigger via trigger coupling diode, D509. The signal from the Schmitt Trigger is differentiated by C504, D509 and D525. Diode, D525, acts as a clamping diode which enables the bias on D509 to be closely controlled. In the quiescent condition, D509 is cut off but the amplitude of the trigger signal is sufficient to cause conduction. The rising collector potential of TR505 resulting from triggering is coupled via R527 and speed-up capacitor, C508, to the base of TR508. Transistor, TR508, conducts and its falling collector potential is coupled back via R517 and speed-up capacitor, C506, to the base of TR505. The over-all action results in very fast switching from one state to the other.

The negative excursion at the base of TR505 causes trigger coupling diode D509, to cut off so that TR505 is isolated from further trigger signals. In this condition, the two diodes, D516 and D517, which control the gate of field effect transistor, TR510, are cut off and the timing capacitor selected by S8AF commences to charge through the timing resistor selected by S8BF.

The field effect transistor operates as a source follower and has a constant current transistor, TR511, in its source circuit. The rising gate potential at TR510 causes signal current to flow to the base of TR512 which is an emitter follower driving current into Zener diode, D520. Thus as the gate potential of TR510 rises (following the increasing charge on the timing capacitor) the emitter of TR512 rises and causes the potential at the junction of R545 and R26 to rise. This bootstrap feedback maintains the potential across the charging resistor virtually constant to ensure a constant charging current and thus a linear timebase. The output waveform of the timebase is connected from the emitter of TR512 to:

(a) The base of TR513 through stopper R576
(b) The base of TR507 in the Hold Off Circuit.

4-12. HOLD OFF

In the Hold Off circuit shown in Fig. 7, the potential applied to TR507 charges the Hold Off capacitor selected by S8. The positive voltage developed across the hold off capacitor is applied to transistors, TR507 and TR506, which form a compound emitter follower with a high current gain. The output from the emitter follower is returned from the potential divider of R523 and R524 in the emitter circuit and via diode, D510, to the base of TR505 in the Timebase Bistable circuit. Also trigger coupling diode, D509, is cut off so that trigger pulses are isolated from the base of TR505 from the time the timebase waveform commences, until the timing capacitor has completely discharged at the end of the sweep.

As the output potential rises it reaches a level at which D510 and hence TR505 conducts, thus causing the Timebase Bistable to revert to its quiescent condition. The amplitude that the timebase ramp waveform reaches before TR505 conducts is determined by the potential divider of R523 and R524, preset to determine the required sweep length.

When the Timebase Binary resets, the collector potential of TR509 is negative going and allows D516 and D517 to conduct and discharge the timing capacitor through TR509. Whilst the timing capacitor discharges, the positive voltage on the hold off capacitor is applied via TR507 and TR506 to the trigger coupling diode, D509. But with no timing waveform from the emitter of TR512 to maintain the charge on the hold off capacitor, the hold off voltage decays towards −15V through R574. The Timebase Binary is then ready to be retriggered.

4-13. OUTPUTS FROM THE TIMEBASE BINARY

The rectangular waveform at the collector of TR505 is fed:

(a) via R575 to front-panel connector SKF to provide a probe test waveform. (Gate 10V)
(b) via the network of R520, R578 and D511 to provide the actuating signal for the Channel Switch Binary when the alternate mode of operation is used.
(c) via R516 to the base of emitter follower, TR110, where it is fed to the tube as a blanking pulse when the sweep is not occurring.

4-14. BRIGHT LINE AUTO

If in the Auto mode, the trigger signal for the timebase is lost or becomes too small to trigger reliably, the bright line auto circuit causes the timebase to free run by removing the bias from the Timebase Bistable. In this condition, a bright trace is produced irrespective of the timebase speed selected. The circuit shown in Fig. 7 contains transistors, TR502 and TR503, which function as a monostable subject to the conduction of transistor, TR501. If a trigger signal is present, the monostable is triggered and its output is fed via emitter follower, TR504,

to the diode gate of D507 and D508 which is in the bias circuit of the Timebase Binary. The Timebase Binary is maintained in one of its stable states until D509 conducts. Conduction of D509 is effected by two conditions.

(a) A pulse applied via C504 from the Schmitt Trigger.
(b) When D508 is allowed to conduct, therefore increasing the current through D525 (R518 supplied a threshold current to D525).

When D509 conducts due to the absence of a signal from TR504, the timebase is in a free run condition.

As mentioned, operation of the monostable is a function of the conduction of TR501. This transistor conducts when the LEVEL control is set to AUTO (pin 2 being switched to −15V). In the AUTO mode, the output from the monostable is present at frequencies above 40 Hz and absent below 30 Hz.

4-15. VARIABLE SWEEP

Full variation of potentiometer, R26, effects approximately 3:1 change in the timing current to give overlap on the adjacent slower speed range.

4-16. LINEARITY AT FAST SPEED

The network of D513, R532, R533, R537, C509 and C511 between the collector of TR508 and the gate of TR510, improves the linearity of the timebase waveform on the fast ranges.

4-17. EXT X AND X−Y FUNCTIONS

When the TIME/CM switch is set to EXT X or X−Y, −15V is applied via D528 and R518 to inhibit the Timebase Bistable. The EXT X signal on SKB is fed to the gate of TR510 via R31 and the TIME/CM switch. The X−Y connection is taken from the collector of TR216 in the Trigger Amplifier and fed to the gate of TR510 via R29 and the TIME/CM switch.

4-18. X AMPLIFIER

The ramp waveform developed at the emitter of TR512 is applied to the base of TR513 which, with TR514, operates in a differential amplifier configuration as shown in Fig. 7. The X shift voltage derived from potentiometers, R27 and R28, is applied to the base of TR514 so that the DC level of the ramp waveform can be adjusted. Position potentiometers, R27 (coarse control) and R28 (fine control), are mechanically coupled so that backlash is introduced on the drive to R27. Potentiometer, R28, is driven directly and R27 is only driven when the backlash has been taken up.

The output of the differential amplifier is fed into the differential cascode amplifier containing transistors, TR515 to TR518, inclusive. Diodes, D521 and D522, prevent saturation of TR515, and diodes, D523 and D524, prevent saturation of TR517. High frequency compensation is effected by C513 and R564. The output is routed via pins 20 and 21 to the X plates of the tube.

4-19. CHOP MULTIVIBRATOR

The Chop Multivibrator shown in Fig. 8 contains transistors, TR401 and TR402, which operate as an emitter coupled astable multivibrator whose frequency of 500 kHz is determined by C406, R405 and R412.

In addition to operation for the chop function, the circuit acts as a monostable when the alternate mode of beam switching is used. In the alternate mode, the circuit produces 1 pulse per timebase sweep and is fed with an end of sweep pulse routed to pin 4 from the Timebase Bistable. Also, −15V is applied (at any timebase speed corresponding to the alternate mode) to pin 6 in the emitter circuit of TR401 and TR402. Application of the −15V increases the current through TR401 and causes a drop in the level of the collector voltage.

This drop cuts off TR402 because the emitter is prevented from going as negative as the base by D401, R410 and R411. The negative-going end of sweep pulse thus finds the circuit in a monostable condition which it triggers and produces a high amplitude pulse at the collector of TR402. It should be noted that −15V is also applied to pin 6 when the instrument is operated in the single trace mode. The −15V is applied via the OFF switch on the back of either Y position control.

Two outputs are taken from the collector of TR402. One is routed via pin 5 as a chop blanking pulse to the tube, and the other is attenuated by R409 and then fed as drive to the Channel Switch Binary. In the CH1 and CH2 mode, −15V is applied to R458 cutting off TR402 and preventing chopped blanking when TIME/CM is set to 1 S/cm to 1 mS/cm inclusive.

4-20. CHANNEL SWITCH BINARY

The Channel Switch Binary circuit shown in Fig. 8 contains transistors, TR407 and TR408, which in the dual trace mode produce a ÷ 2 function. The input signal is steered to the required base by diodes, D403 and D405.

The ÷ 2 operation is a function of the settings of the CH1 and CH2 position control. For dual trace operation neither CH1 nor CH2 are at the OFF setting, and pins 10 and 16, are connected via the switch on each shift control to −15V. As a result diodes, D402 and D406, are cut off and the circuit is allowed to operate in the ÷ 2 mode.

If CH1 position control is set to OFF, the −15V is disconnected from pin 10 and current flows into the base of TR407 via R429 and D402. This biases the Channel Switch Binary into the condition required for single trace CH2 operation. The circuit is similarly biased if the CH2 position control is set to OFF.

If both CH1 and CH2 controls are set to OFF, D404, D407, D220, R322 and R321 ensure that both traces are deflected off the screen. In the CH1 + CH2 mode, R459 and R470 are connected to −15V. These cut off both TR407 and TR408 which in turn causes the Channel Switch to switch on CH2 and CH2 channels simultaneously.

4-21. DELAY LINE

The Delay Line shown in Fig. 8 is in printed circuit type and introduces a delay of 150 nS. This time allows for delay in the timebase and bright up circuits and ensures that the first part of a signal is visible. Two resistors, R415 and R455, terminate the Delay Line with the required characteristic impedance.

Two emitter followers, TR403 and TR404, prevent loading of the Delay Line by subsequent stages of the Output Amplifier.

4-22. OUTPUT AMPLIFIER

The first stage of the Output Amplifier shown in Fig. 8 contains transistors, TR405 and TR406, which operates as a differential amplifier. High frequency compensation is effected by trimmer capacitor, C411. The remaining four transistors, TR409, TR410, TR1 and TR2, operate as a differential cascode amplifier. The output from the amplifier is routed out via pins, 12 and 14, to the Y plates of the tube.

4-23. POWER SUPPLIES

All power supplies are derived from the power supply transformer T1 shown in Fig. 9. The primary is switched by S10, the double pole switch on the GRAT control, and protected by fuse, F1, mounted on the rear panel. Six different tapping combinations of the primary winding connections can be selected by S12 the SUPPLY VOLTAGE selector mounted on the rear panel.

The transformer has four secondary windings which develop the following r.m.s. voltages; 125V. 34V (center tapped), 6.3V and 850V. The output of the 125V windings energizes the front-panel neon, LP1, and is rectified by the full wave bridge configuration of D3, D4, D5 and D6. After filtering, the output from the bridge is used as the +150V unregulated supply voltage and is protected by fuse FS2.

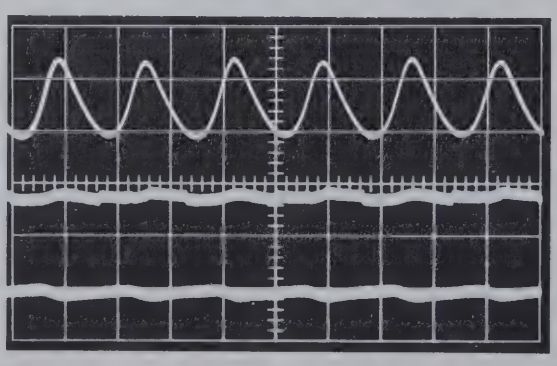
The 34V developed across the center tap winding is rectified by the full bridge configuration of D7, D8, D9 and D10. Two outputs of + 20V and – 20V filtered by C23 and C24, respectively are derived from the bridge and applied to separate regulator circuits to produce the + 15V and – 15V regulated voltages: Both circuits operate in an identical manner; therefore only the + 20V circuit is described.

Zener diodes, D602 and D603, are fed with constant current by TR602 and their combined stabilized voltage fixes the base bias of emitter follower, TR3. The stabilized emitter output voltage is the + 15V supply voltage. If the + 15V supply tends to draw excessive current, the resultant voltage drop across R608, R609 and R610, biases D601 into conduction so that the current is limited to a safe level.

The 6.3V winding energizes the heater of the cathode ray tube V1. This supply is insulated to withstand voltages above 1 kV.

The 850V winding is fed to two rectifier circuits to obtain voltages of –1kV and +3kV. Diodes, D616, D617 and D618, rectify the 850V to produce –1kV for the electrode bias network of V1; and diodes, D621; D622 and D623 in conjunction with C614, C615 and C616, rectify and triple the 850V to produce the final anode voltage of +3kV. Both supplies are regulated by a circuit which is a form of DC controled AC bridge. This bridge is effectively in series with the 850V supply to both the P1kV and the +3kV circuits, and the circuit operates such that a DC control voltage developed across the bridge opposes the 850V. The DC control voltage is developed across TR607. The base control current for the transistor is fed from the +150V rail via R625, but it should be noted that this resistor also pases current via D619 to the low impedance voltage point at the emitter of emitter follower, TR608. Thus any variation of voltage at the emitter of TR608 alters the current through D619 and, as a result, the base current of TR607. In turn, this determines the Vce of TR607 and hence the DC voltage develo across the bridge.

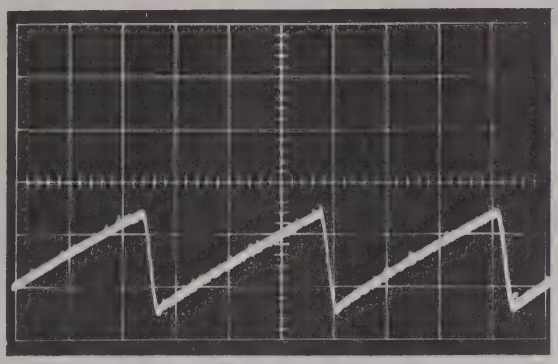
The emitter voltage of TR608 is determined by the potential divider arrangement of fixed resistors, R631, R629 and preset resistor, R628. This potential divider is connected from the P1kV rail to the stabilized +15V rail which is used as a reference. The base of TR608 is connected to the potential divider so that the voltage at the emitter is a reduced version of any tendency of the potential of the –1kV rail to vary. Thus any voltage variation at the emitter of TR608 varies the DC control voltage across the bridge and thus opposes the initial voltage variation of the –1kV rail. The effect is to regulate the common AC supply to both the –1kV and +3kV rails.



Low Voltage Power Supply Ripple
Mid Line – No Sweep – No Inputs
5 ms/cm

+150 V Supply	500 mV/cm	Y
+15 V Supply	5 mV/cm	Y
–15 V Supply	5 mV/cm	Y

Figure 4-1. Low Voltage Power Supply Ripple

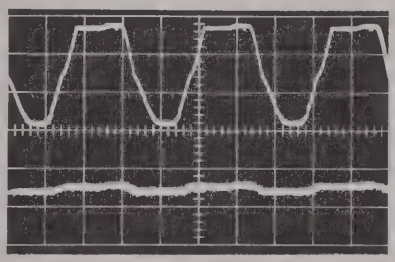


Junction of R631 and D618 to ground
Mid Line
200 mV/cm Y
5 ms/cm X

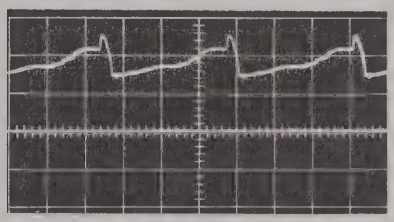
Figure 4.2 –1 kV Power Supply Ripple

High Line

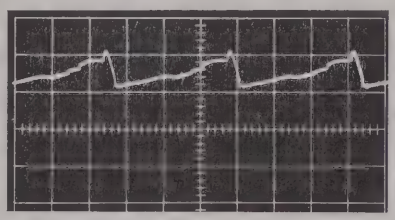
Low Line



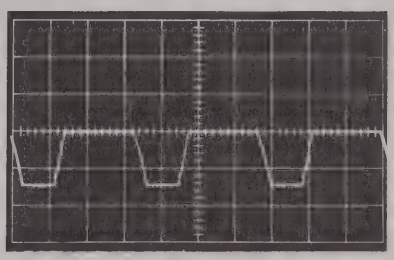
Junction of Pin 15 (Fig. 9) to ground
200 V/cm Y
5 ms/cm X



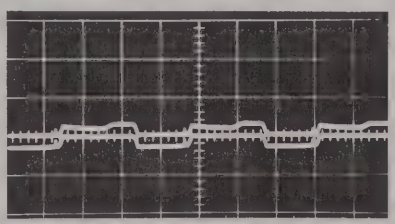
Junction of D619 and R630 to ground
Zero volts at center
200 V/cm Y
5 ms/cm X



Junction of R631 and R629 and base of TR608 to ground
Mid Line
200 mV/cm Y
5 ms/cm X



Junction of D619, R625 and base of TR607 to ground
Mid Line
Zero volts at center of graticule
200 V/cm Y
5 ms/cm X



Collector of TR607 to ground *(Low Line)*
Base of TR607 to ground *(Low Line)*
Zero volts at center of graticule
200 mV/cm Y
5 ms/cm X

Collector of TR607 to ground *(High Line)*

Emitter of TR607 to ground *(High Line)*
Zero volts at center of graticule
200 V/cm Y
5 ms/cm X

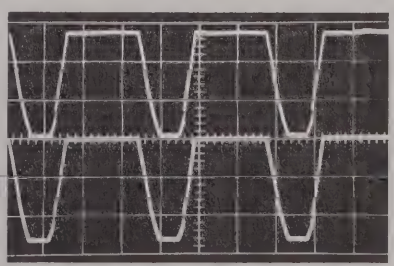


Figure 4-3. High Voltage Power Supply Waveforms

4-24. CALIBRATOR

The 1V ± 2% voltage at the CAL 1V connector, SKG shown on Fig. 9, is produced by TR604. The current through R617 is alternately passed through the base of TR604 and one half of the 34V winding via D608. During the positive and negative half cycles of 17V, TR604 alternately saturates and cuts off, respectively, and produces a square wave at its collector. The amplitude of the pulse is preset by adjustment of R614.

4-25. GRATICULE ILLUMINATION

Two front-panel lamps, LP2 and LP3 shown in Fig. 9, illuminate the graticule and are energized by DC derived from full wave rectification of the 34V r.m.s. by diodes, D11 and D12. Illumination is varied by the DC level determined by R37, the front-panel GRAT control. Transistor, TR601, is used as a control element to reduce power dissipation.

4-26. BLANKING

The pulse which blanks the CRT when a sweep is not occurring is produced by the circuit containing transistors, TR605 and TR606 shown in Fig. 9. The blanking pulse from the Timebase Binary is applied to the base of emitter follower, TR606. The output pulse at the emitter is directly coupled to the base of TR605. This transistor acts as a switch across R623 which with R622 forms a potential divider across the +150V rail and ground. When TR606 is cut off, the junction potential of R622 and R623 is approximately +75V and this potential, routed via pin 19 to the CRT, blanks the tube. When TR606 conducts, the junction potential is virtually ground, and the tube is allowed to conduct. Blanking is not required in the EXT X and X–Y modes and the beam is always switched ON when in these modes.

4-27. LINE TRIGGER SOURCE

The 17V r.m.s. developed across one half of the center tap secondary winding of T1, is applied to the potential divider of R619 and R620 shown on Fig. 9. The junction potential is routed out via pin 14 and fed to wafer S5AF, of the TRIG SELECT switch.

4-28. Z MOD BLANKING

At the INT setting of the Z MOD switch, S11 in Fig. 9, a blanking pulse from the collector of TR402 in the Chop Multivibrator is applied to the grid of the tube. The pulse blanks the tube during the chop switching period of the trace. At the EXT setting, the switch selects the signal from SKH.

4-29. CRT BIAS AND TRACE ORIENTATION

The ASTIG control, R38, and the GEOM control, R639, shown in Fig. 9, are fed from the +150V rail. The INT control, R41, and the FOCUS control, R39, are connected in series and fed from –1kV.

Correct orientation of the trace is set up at the factory by means of potentiometer, R633, and a phase reversal tap. Once this adjustment has been made to the tube there is no need for readjustment.

Maintenance

5-1. GENERAL

Right-hand, left-hand and bottom views of the 1066B are shown in Fig. 1, Fig. 2 and Fig. 3, respectively. Access to all preset components is possible when the upper and lower covers have been removed.

5-1a. FUSES

The 1A supply fuse is mounted on the rear panel. The internal 150V line fuse, 250 V line fuse, 250 mA is mounted on the Timebase Board.

5-1b. REMOVAL OF COVERS

Each cover is retained in position by four latch fasteners. Each fastener is released by turning it one quarter of a turn counter-clockwise.

5-2. REMOVAL OF PRINTED CIRCUIT BOARD ASSEMBLIES

Removal procedures for each of the Printed Circuit Board Assemblies are as follows:

5-2a. Y AMP AND TRIG.

1. Access to the front of the Board is possible without removing. However, if access is required to the rear, it is necessary to proceed as follows:
2. Remove and identify the leads from pins 23, 26, 30 and 47.
3. Remove the operating rod from the INVERT Y2 switch. Remove the four fixing nuts.
4. The Board can now be hinged on the wiring along the edge shown in Fig. 11, when released from its spring clips.

5-2b. POWER SUPPLY BOARD

1. Remove the lead from pin 19.
2. Remove the 5 retaining screws shown in Fig. 11.
3. The Board complete with the mounting bracket for the power transistors can now be hinged on the wiring along the edge shown in Fig. 11.

5-2c. Y ATTEN. ASSEMBLIES

1. Remove the seven screws retaining the shield. Access to most areas of the two Boards is possible without removal. However, if full access is required, it is necessary to proceed as follows:
2. Remove and identify the leads from pins, 2, 3, 4, 5 and 6.
3. To remove the CH1 Attenuator
   (a) Remove and identify leads from pins, 13, 14 and 15.
   (b) Remove the connection from the Y1 frontpanel socket, and remove the castle retaining nut on the BNC connector.
   (c) Remove the control knobs and fixing nut on the CH1 VOLTS/CM switch.
   The complete CH1 Attenuator can now be removed.
4. To remove the CH2 Attenuator,
   (a) Remove and identify leads from pins, 18, 19 and 20.
   (b) Remove the connection from the CH2 frontpanel connector and remove the retaining nut on the BNC socket.
   (c) Remove the control knobs and fixing nut on the CH2 VOLTS/CM switch.
   The complete CH2 Attenuator can now be removed.

5-2d. Y OUTPUT AND BEAM SWITCH

1. Remove the four retaining screws.
2. Remove the lead from pin 5. The Board is now free.

5-2e. TIMEBASE AND X AMP

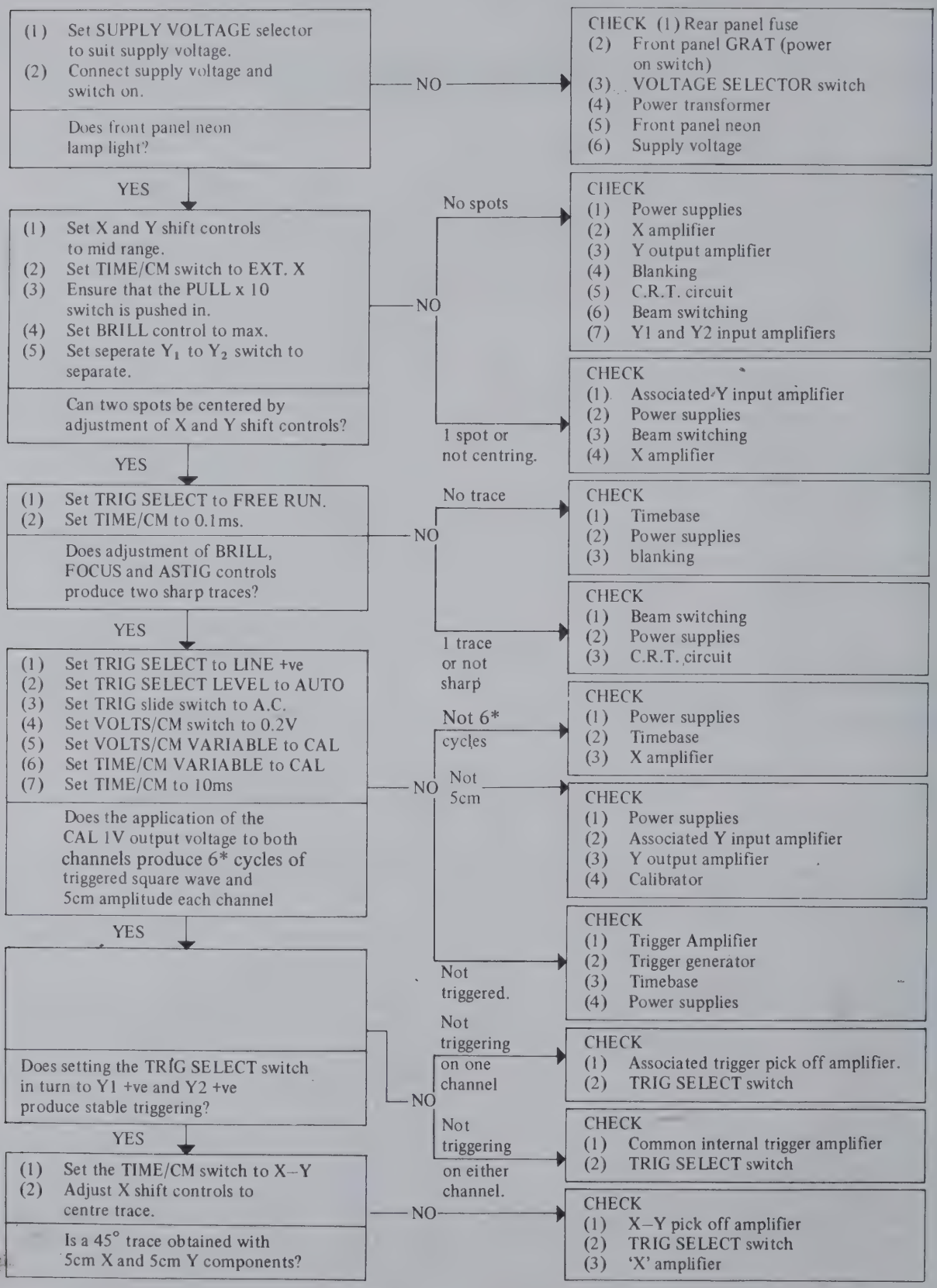
Access to the front of the Board is straightforward, but to gain further access to the rear it is necessary to proceed as follows:

1. Remove the three corner retaining screws and the two screws shown on Fig. 11.
2. Remove the control knobs, fixing nut and the two rear bracket fixing screws from the TIME/CM switch so that the switch is held loosely in position by its associated wiring.
3. Ease the Board outward, displacing the TIME/CM switch as necessary to obtain access to the rear of the Board.

5-2f. TUBE

Access to the rear of the tube is possible by removing the base cover. The tube may be removed by withdrawal from the front, after releasing the clamp at the rear. Care should be taken to release the trace rotation coil before the tube is fully withdrawn.

Table 3. Fault Localization


(1) Set SUPPLY VOLTAGE selector to suit supply voltage.
(2) Connect supply voltage and switch on.
Does front panel neon lamp light?
NO
CHECK (1) Rear panel fuse
(2) Front panel GRAT (power on switch)
(3) VOLTAGE SELECTOR switch
(4) Power transformer
(5) Front panel neon
(6) Supply voltage
YES
(1) Set X and Y shift controls to mid range.
(2) Set TIME/CM switch to EXT. X
(3) Ensure that the PULL x 10 switch is pushed in.
(4) Set BRILL control to max.
(5) Set seperate Y_1 to Y_2 switch to separate.
Can two spots be centered by adjustment of X and Y shift controls?
NO
No spots
CHECK
(1) Power supplies
(2) X amplifier
(3) Y output amplifier
(4) Blanking
(5) C.R.T. circuit
(6) Beam switching
(7) Y1 and Y2 input amplifiers
1 spot or not centring.
CHECK
(1) Associated Y input amplifier
(2) Power supplies
(3) Beam switching
(4) X amplifier
YES
(1) Set TRIG SELECT to FREE RUN.
(2) Set TIME/CM to 0.1ms.
Does adjustment of BRILL, FOCUS and ASTIG controls produce two sharp traces?
NO
No trace
CHECK
(1) Timebase
(2) Power supplies
(3) blanking
1 trace or not sharp
CHECK
(1) Beam switching
(2) Power supplies
(3) C.R.T. circuit
YES
(1) Set TRIG SELECT to LINE +ve
(2) Set TRIG SELECT LEVEL to AUTO
(3) Set TRIG slide switch to A.C.
(4) Set VOLTS/CM switch to 0.2V
(5) Set VOLTS/CM VARIABLE to CAL
(6) Set TIME/CM VARIABLE to CAL
(7) Set TIME/CM to 10ms
Does the application of the CAL 1V output voltage to both channels produce 6* cycles of triggered square wave and 5cm amplitude each channel
NO
Not 6* cycles
CHECK
(1) Power supplies
(2) Timebase
(3) X amplifier
Not 5cm
CHECK
(1) Power supplies
(2) Associated Y input amplifier
(3) Y output amplifier
(4) Calibrator
YES
Not triggered.
CHECK
(1) Trigger Amplifier
(2) Trigger generator
(3) Timebase
(4) Power supplies
Does setting the TRIG SELECT switch in turn to Y1 +ve and Y2 +ve produce stable triggering?
NO
Not triggering on one channel
CHECK
(1) Associated trigger pick off amplifier.
(2) TRIG SELECT switch
Not triggering on either channel.
CHECK
(1) Common internal trigger amplifier
(2) TRIG SELECT switch
YES
(1) Set the TIME/CM switch to X–Y
(2) Adjust X shift controls to centre trace.
Is a 45° trace obtained with 5cm X and 5cm Y components?
NO
CHECK
(1) X–Y pick off amplifier
(2) TRIG SELECT switch
(3) 'X' amplifier

*Applicable to 60 Hz line frequency only.
Use 5 cycle display for 50 Hz line frequency.

5-3. FAULT FINDING TABLES

Faults may be localized by reference to the Fault. Localization information presented in Table 3, and the Circuit Voltages listed in Table 4.

Table 4 should be used as a general guide to voltages obtained at certain locations on the printed circuit board and can be used as an aid to servicing.

The power input voltage should be approximately mid range of the SUPPLY VOLTAGE setting and the front panel controls placed in the following positions: —INT, X POSITION and CH1 POSITION — all at mid position. CH1 POSITION — to CH2 OFF position CH1 and CH2 INPUT switches — to ground position

TRIG SELECT	—	to CH1 +
AC/ACF/DC	—	to AC
LEVEL	—	to AUTO
TIME/CM	—	to EXT. X
NORM/TVL/TVF	—	To NORM

Figures in parenthesis indicate voltages with LEVEL set to mid position and TIME/CM set to 1 ms.

When faults have been cleared, it is recommended that the test procedure is implemented to ensure that the instrument conforms to the Specification. Any calibration adjustments found to be necessary must not be made until a 15 minute warm up period has elapsed.

5-4. POWER SUPPLY VOLTAGES

1. Set the INTENSITY control to minimum.
2. Set the SUPPLY VOLTAGE switch on the rear panel to suit the supply. Apply the supply voltage via the Variac set to the mid range of the SUPPLY VOLTAGE setting.
3. Check that the GRAT switch operates and neon, LP1, energises.

NOTE

- The supply voltage to the instrument must be exactly mid range when setting or measuring voltages.

4. Check the voltage to chassis on the following pins on the Power Supply printed circuit board are within the following limits.

pin 22	+ 14.5 V to + 16 V
pin 25	— 14.5 V to — 16 V
pin 18	+ 145 V to + 160 V
pin 36	> + 2.5 kV

5. Adjust the E.H.T. potentiometer (R628 on Fig. 3) to obtain 130 V across C604.
6. Check that the voltage measured with a multimeter from junction of R631 and C609 to chassis, is within — 920 V and — 1060 V.
7. Ensure that this voltage does not change by more than ± 15 V when the Variac is adjusted in turn to the upper and lower supply voltage limits indicated on the SUPPLY VOLTAGE selector switch.

Table 4. Circuit Voltages

'Y' OUTPUT AND BEAM SWITCH

LOCATION	VOLTAGES
Pin 12 and Pin 14	+ 75 V
TR405 and TR406 collectors	+ 8.7 V
Pin 9	+ 7.5 V
Pin 15	+ 2.8 V
TR409 and TR410 collectors	+ 12.0 V
Pin 1 and 2	+ 6.4 V
TR401 collector	+ 10.0 V
TR402 collector	+ 50 V

Y AMP AND TRIG.

TR209 and TR210 collectors	+ 6.3 V
TR211 and TR212 collectors	+ 3.4 V
TR205, 206, 207 and 208 emitters	+ 7.5 V
TR201, 202, 203 and 204 collectors	+ 5.5V
Pin 2, 5, 8 and 11	+ 1 V
TR215 and TR216 collectors	+ 2.5 V
TR217 collector	+ 1.3 V
TR218 collector	+ 2 V
Pin 35	0 V
TR227 emitter	0 V
Cathode D221	+ 3.9 V (—3.9 V)
TR22 collector	+ 5.7 V
TR223 collector	+ 5.3 V

TIMEBASE AND X AMP.

LOCATION	VOLTAGES
TR501 collector	+ 12.5 V (—0.5 V)
Pin 3	+ 2.4 V (0 V)
TR508 collector	+ 0.2 V (+ 10.4 V)
TR509 collector	+ 15.5 V (+ 2.2 V)
TR506 emitter	+ 3.1 V (—0.1 V)
TR507 collector	—4.8 V (—4.5 V)
TR511 collector	+ 2.9 V (—0.3 V)
Pin 10	+ 14.5 V (+ 11.2 V)
TR513 and TR514 collector	— 8.4 V
TR516 and TR518 collector	— 4.8 V
Pin 20 and Pin 21	+ 75 V

POWER SUPPLY:

Pin 5	+ 20.3 V
Pin 7	— 20.6 V
Pin 19	+ 1.8 V (+ 75 V)
TR608 emitter	+ 0.4 V
Pin 32	— 390 V

Table 5. Recommended Test Equipment

REQUIREMENT	INSTRUMENT OR EQUIVALENT
1. Oscilloscope Calibrator a) Voltage 30 mV to 300 V ± ¼% 1 kHz squarewave b) Time Mark Generator 0.5 μs to 5 sec. ± 0.02% Sine Wave 20 ns and 50 ns c) Fast Rise Square Wave Generator 1 MHz, 100 kHz, 10 kHz, 1 sec Nominally 250 mV into 50 Ω Risetime < 1 ns Flattop, minimum perturbations d) Line Frequency Sine Wave Line Frequency, filtered 10 mV to 1 Volt uncalibrated	Ballantine 6125A
2. D.C. Voltmeter 1 volt to 2 kV 4¼ digits – 100 mV resolution 0.05% Accuracy 10 megohm Input Resistance 300 volts off ground	Ballantine 3600 A/B
3. Multimeter Volts AC/DC, 0-2.5 μV AMPS AC/DC Ohms. Input > 20,000 Ω/Volt 5% Accuracy	Simpson 260
4. A.C. True RMS Voltmeter 1 mV to 300 V rms 2% Accuracy (to 100 kHz) 2 Hz to 20 MHz	Ballantine 323L
5. Variable Auto Transformer 95 to 135 Volts	General Radio W5MT3AW
6. Sine Wave Generator, Constant Amplitude 0.1 to 2.5 volts p-p 50 kHz to 50 MHz Flatness ± 3%	Tektronix 190/191
7. Alignment tool, Insulated	JFD 5284
8. 50 Ω Termination BNC/BNC – 3% 1 Watt	Ballantine 12630A
9. Resistor 215 kohm ¼W 1% Film	Ballantine 12-12232-OA
10. Capacitance standardizer 28 pF – shielded HIgh Impedance frequency compensated attenuator with BNC Connectors giving 2X attenuation when used with 1 MΩ 28 pF load. Accuracy within 5% to 100 kHz	Ballantine 10650A
11. Attenuator, 50 Ω, 20 dB ± 0.3 dB Flat dc to > 100 MHz GR 874 to BNC Adapters (2)	General Radio 874-G20
12. Cable, BNC/BNC, RG58A/U, 120 cm, (4 Ft.) 20 cm, (8 inches),	Ballantine 12249D Ballantine 12249A
13. Cable, BNC/Alligator Clips 120 cm, (4 ft.)	Ballantine 12250D

5-5. BEAM CONTROL

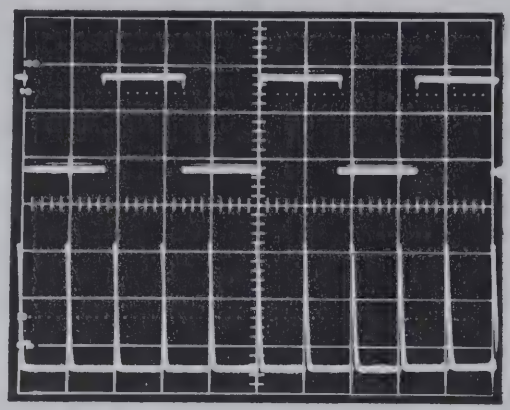
1. Set the front panel controls as follows:
   (a) CH1 VOLTS/CM to 20 mV.
   (b) CH1 position control to mid range
   (c) CH2 position to CH2 OFF
   (d) X position to mid range
   (e) PULL X10 to 'off' (i.e. the control is pushed in)
   (f) TIME/CM to EXT X
   (g) CH1 input slide switch (S1) to ground
   (h) INTENSITY to mid range
   (i) SEPARATE/CH1 and CH2 switch to SEPARATE
2. Adjsut the CH1 BAL control and R541 TIME/CM (Fig. 1) to center a spot on the screen.
3. Set the ASTIG control for a round spot and adjust the INTENSITY and FOCUS controls as necessary but ensure that these controls are not at the end of their travel at the optimum setting.
4. Set
   (a) CH1 VOLTS/CM VARIABLE and CH2 VOLTS/CM VARIABLE to CAL
   (b) CH2 VOLTS/CM to 20 mV.
   (c) CH2 slide switch (S3) to ground
   (d) Z MOD switch on rear panel to INT
5. Adjust CH1 BAL control to eliminate spot movement when switching CH1 VOLTS/CM from 20 mV to 5 mV.
6. Obtain a second spot by setting the CH2 position control to mid range and adjust CH2 BAL control to eliminate spot movement when switching CH2 VOLTS/CM from 20 mV to 5 mV.
7. Check that the two spots are round and separate over a normal range of intensity and that each Y position control moves each spot well off the screen in both directions independently (slight interaction is acceptable).
8. Move both spots to the graticule center-line by means of the position controls. Switch the SEPARATE CH 1 + CH2. Check that the combined spot is not more than ±2 cm from the graticule horizontal center line.

5-6. TIMEBASE TRACE

Set
   (a) The TIME/CM switch to 0.1 ms.
   (b) TRIG SELECT to FREE RUN.
2. Check that two traces are displayed.
3. Center the traces with the X position control.
4. Adjust GRAT control and ensure that the graticule illumination operates correctly.
5. Observing either trace, adjust R633 (Fig. 3) to rotate the trace to be exactly parallel to the horizontal center line.
6. If the tube has been changed and there is insufficient range, interchange leads on pin 30 and 31, of the Power Supply board.
7. Set the Y position controls so that the two traces are near the top and bottom of the screen.
8. Adjust the GEOM control (R639 in Fig. 3) to give minimum bowing of both horizontal lines.

5-7. TIMEBASE ACCURACY

1. Set the TIME/CM switch to X–Y and center the spot with X position and CH2 position controls.
2. If necessary, re-adjust the FOCUS and ASTIG controls to obtain a sharp round spot.
3. Set
   (a) CH1 VOLTS/CM VARIABLE to CAL.
   (b) Input slide switch (S1) to DC.
   (c) X1 gain (R556 on Fig. 1) to mid position.
4. Set CH1 VOLTS/CM to 5 mV.
5. Using the Ballantine 6125A Oscilloscope Calibrator, apply a 5 mV x 2 x 5 square wave to CH1 input BNC.
6. Adjust X10 gain (R552 on Fig. 1) to obtain 10 cm spacing of the spots along the horizontal center line.
7. Set
   (a) CH1 VOLTS/CM to obtain a suitable setting depending on marker amplitude.
   (b) TRIG SELECT to CH1 +
   (c) Trigger coupling to AC.
   (d) TRIG LEVEL to mid position.
8. Set
   (a) TIME/CM switch to 1 ms.
   (b) TIME/CM VARIABLE to CAL.
   (c) PULL X10 to out position.
9. Using the Time Mark Output of the 6125A Calibrator, apply 0.1 ms markers to CH1 input BNC.
10. Obtain a stable display by adjustment of TRIG LEVEL control.
11. Adjust R541 TIME/CM (Fig. 1) to obtain 1 mark per cm.
12. Push in the PULL X10 control, change input marker signal to 1 ms and adjust X1 gain (R566 on Fig. 1) to obtain 1 mark per cm.
13. Set the TIME/CM switch to X–Y then repeat (4) to (12), inclusive.
14. Set the TIME/CM switch to 1 μs markers to the CH1 input BNC.
15. Adjust C16 (fig. 1) to obtain 1 mark per cm.
16. Using the Time Mark Generator, measure the accuracy of all TIME/CM ranges with the PULL X10 control 'in' and ensure that the accuracy is better than that given in specification.
17. Check that the sweep starts within 0.5 cm of the same point on all ranges and that the TIME/CM VARIABLE control reduces the speed by greater than 2.5:1 on any range.
18. Check that the trace length is greater than 10 cm on all ranges.
19. Measure the accuracy on the 0.5 μs/cm range with the PULL X10 control 'out' and ensure that the accuracy is better than that given in Specification ignoring the first cm of trace.
20. Push the PULL X10 switch 'in' and set the CH1 and CH2 VOLTS/CM switches to 5 mV.



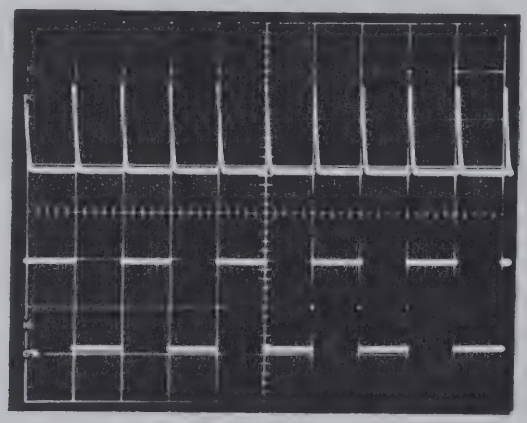
5 ms/cm
Line Frequency (60 Hz = 16.67 ms)
CAL 1 V jack on panel
(See Note Below)

Time Mark Generator
5 ms and 50 μs marks
(Note Calibration Linearity)

NOTE:
On 50 Hz power supply input period of calibration square wave is 20 ms

With time base set to 5 ms/cm check for 2 1/2 cycles full scale.

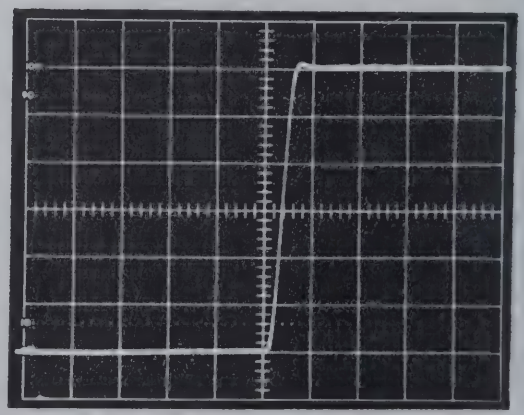
Figure 5-1. Horizontal Time Calibration



1 ms time markers

Amplitude Calibrating Square Wave

Fast Rise Time
50 Ω system
50 us/cm timebase



5-2. Ballantine 6125A Calibrator Waveforms

5-8. Y GAIN

1. Set the CH1 TIME/CM switch to 0.5 ms.
2. Using the Voltage Calibrator, apply a 5 mV x 1 x 5 1 kHz square wave to the CH1 input socket and obtain a stable display.
3. Adjust R242 (fig. 3) to obtain 5 cm amplitude of square wave.
4. Set
   (a) CH2 input slide switch to DC.
   (b) CH2 VOLTS/CM VARIABLE to CAL.
   (c) TRIG SELECT to CH2 +
5. Using the Voltage Calibrator, apply a mV x 1 x 5 square wave to CH2 input connector and obtain a stable display.
6. Adjust R247 (Fig. 3) to give 5 cm amplitude of square wave.

5-9. Y ATTENUATOR

1. Using the 6125A Oscilloscope Calibrator, apply a 5 mV x 1 x 5 square wave to the CH2 input BNC via the 28 pF Capacitance Standardizer Model 10650A.
2. Adjust the 5 mV input capacitor, C105 (Fig. 3), to give a square corner tothe positive-going edge.
3. Set the CH2 VOLTS/CM switch to 50 mV and apply a 50 mV x 1 x 5 square wave direct to the CH2 input BNC.
4. Adjust C103 (Fig. 3) to give a square corner.
5. Set the CH2 VOLTS/CM switch to 0.5 V and increase the square wave input to 0.5 V x 1 x 5.
6. Adjust C101 (Fig. 3) to give a square corner.
7. Apply a V x 1 x 5 square wave from the Oscilloscope via the Capacitance Standardizer and adjust C102 (Fig. 3) to give a square corner.
8. Reduce the square wave input to 0 V x 1 x 5 and reset CH2 VOLTS/CM to 50 mV.
9. Adjust C104 (Fig. 3) to give a square corner.
10. Remove the Capacitance Standardizer. Then with the square wave applied, check at all settings of the CH2 VOLTS/CM switch with the amplitude of the applied square wave adjusted to give 5 cm of display, that the corners of the waveform are square and accuracy is better than the ± 3% stated in the specification on every range.
11. Set TRIG SELECT to CH1 + then repeat (1) to (10), inclusive except read CH1 for CH2.

5-10. Z MODULATION

1. Apply a 1 kHz square wave of 0.2 V x 2 x 5 amplitude to the Z MOD connector on the rear panel and to CH1 input BNC with CH1 VOLTS/CM switch set to 1 V.
2. Obtain a stable display. Then observe that blanking is visible only when the Z MOD switch is set to EXT.
3. Increase the input to 0.5 V x 2 x 5 and observe that the trace Intensity is even, during both blanked and unblanked portions of the square wave.
4. Remove the signal and set Z MOD switch to INT.

5-11. CAL 1V

1. Set
   (a) CH1 and CH2 VOLTS/CM VARIABLE controls to CAL.
   (b) CH1 VOLTS/CM to 0.2V.
2. Using the Scope Calibrator apply 0.1 V x 2 x 5 1 kHz square wave to CH1 input BNC.
3. Note the exact deflection then connect the CAL signal to the CH2 input BNC, adjusting the setting of the TIME/CM switch as required to obtain several cycles of square wave display. Adjust R614 (Fig. 3) to give the deflection amplitude previously noted.

5-12. TRIGGERING

1. Line Trigger check
   (a) Connect line frequency sine wave of approximately 1 V to CH1 input. Set CH1 attenuator to 1 V/cm.
   (b) Set TRIG SELECT switch to LINE + and AC
   (c) Check that sine wave is stably displayed with LINE + and LINE −.
2. CH1 trigger check
   (a) Connect 15 volts of 1 kHz square wave calibration voltage to CH1 input. Set oscilloscope calibrator to 5 V and 3 Div.
   Set CH1 attenuator to 5 volts/cm.
   (b) Set TRIGGER SELECT switch to CH1 + and AC
   (c) Check that it is possible to obtain a stable display with + trigger slope.
   (d) Set TRIGGER SELECT switch to CH1 −.
   (e) Check that it is possible to obtain a stable display with − trigger slope.
3. Set AC/ACF/DC switch to ACF and CH1 VOLTS/CM switch to 2 volts/cm.
   Leave signal input for CH1 as described above in section 2a.
   Check that two stable trigger conditions of opposite slope can be found at two settings of the LEVEL control.
4. Set the AC/ACF/DC switch to AC and the NORM/TVL/TVF switch to TVL and CH1 attenuator switch to 10 VOLT/CM.
   Check that a stable display of + slope is possible at relatively uncritical settings of the level control.
5. Repeat (4) with slide switch set to TVF.
6. Check on Internal Triggering in Auto Mode. Set the following controls
   (a) Scope Trigger switch to AC and NORM/TVL/TVF switch to NORM
   (b) Scope CH1 attenuator to 5 Volts/cm.
   (c) Scope LEVEL control to AUTO Connect 1 kHz square wave voltage from calibrator to CH1 input. Apply 5 volts and 3 DIV (15 Volts p-p) signal. Check that a stable display of correct slope is obtained on CH1 + and CH1 − settings of the TRIG SELECT switch.

7. Check Level Mode on Internal triggering.
   (a) Leave Input Calibrator signal and CH1 controls as in paragraph 6a and 6b above.
   (b) Turn LEVEL control out of AUTO and adjust it to obtain a stable trace. With this control set to the middle of the range which gives a stable trace, it should be possible to switch to the TRIG SELECT from CH1 + to CH1 – and back without losing trigger.
   (c) Increase CH1 attenuator setting from 5 VOLTS/CM to 20 VOLTS/CM and Repeat step b. The 75 mm p-p amplitude should trigger on CH1 + and CH1 – polarity.
   If required adjust trigger level slope balance potentiometer R293 (Fig. 3) to obtain stable triggering of both polarities when the LEVEL control is set to the middle of its range.
8. DC trigger Internal Level Adjustments
   (a) CH1 DC Trigger Level Adjust. Set AC/ACF/DC switch to DC and LEVEL control to AUTO. Position CH1 trace to the horizontal center line of the CRT graticule. Monitor the DC potential of the Internal Trigger amplifier output on Pin 54 (see Fig 3 Y Amp and Trigger Circuit – output of S7 at base of TR220) with a voltmeter. Adjust R313 (Fig. 3) for zero meter reading within ± 25 mV.
   (b) CH2 DC trigger level adjust.
   Set AC/ACF/DC switch to DC and DEVEL control to Auto. Position CH2 trace to the horizontal center line of the CRT graticule. Monitor the DC potential of the internal trigger amplifier output on Pin 54 (see Fig 3 Y Amp and Trigger Circuit – output of S7 at base of TR220) with a voltmeter. Adjust R311 (Fig. 3) for zero meter reading within ± 25 mV.
9. Internal trigger performance check
   (a) Apply of the CAL 1 Volt jack to the inputs of CH1 and CH2.
   (b) Set CH1 and CH2 coupling switches to DC and both attenuators to 0.2 VOLTS/CM.
   (c) Set LEVEL control to AUTO
   (d) Check that a stable CH2 display of correct slope is obtained when TRIG SELECT switch is set to CH1 + and CH1 –. Rotate CH1 position control to OFF and over its entire range and check that the CH2 trace triggering remains undisturbed by CH1 Position voltage.
   (e) Reset CH1 Position control to mid range.
   (f) Set CH1 coupling switch to GND and CH1 attenuator to 5 mVOLTS/CM.
   (g) Observe that CH2 display is free running when TRIG SELECT switch is set to:
   CH1 + and CH1 –
   EXT + and EXT –
   and that the CH1 trace is clean without tearing when TRIG SELECT switch is set to CH2 +.
   (h) Set CH1 coupling switch to DC
   Set CH1 attenuator to 0.2 VOLTS/CM
   Set CH2 attenuator to 5 VOLTS/CM
   Check that a stable CH1 display of correct slope is possible when TRIG SELECT switch is set to CH2 + and CH2 –. Rotate CH2 position control to OFF and over its entire range and check that the CH1 trace triggering remains undistrubed by CH2 position voltage.
   (i) Reset CH2 Position control to mid range
   (j) Set CH2 coupling switch to GND and CH2 attenuator to 5 mVOLTS/CM.
   (k) Observe that CH1 display is free running when TRIG SELECT switch is set to:
   CH2 + and CH2 –
   EXT + and EXT –
   and that the CH2 trace is clean with no tearing when TRIG SELECT switch is set to CH1 +.
10. External trigger check
   (a) Connect CAL 1 V to the EXT TRIG BNC thru a series 301 kΩ 1% film resistor to divide the 1 volt cal signal to 300 mV p-p.
   (b) Observe the CH1 trace and check that triggering is stable when TRIG SELECT switch is set to EXT + and EXT – in both auto and manual level modes.
11. Check that the displayed traces run free when TRIG SELECT switch is set to FREE RUN, and over the full range of the LEVEL control.
12. Remove the CAL signal interconnections from the instrument.

5-13. PULSE RESPONSE

1. Using the fast rise output, apply a fast rise time 1 μs square wave to CH1 input BNC via a 10 dB 50 Ω attenuator pad and 12630A 50 Ω BNC Feed thru termination.
2. Set
   (a) CH2 Position control to CH2 OFF
   (b) TIME/CM to 0.5 μs
   (c) TRIG SELECT to CH1 +
   (d) CH1 VOLTS/CM to 5 mV
   (e) CH1 VOLTS/CM VARIABLE fully counter clockwise. (Min gain)
3. Obtain a stable display and adjust amplitude of generator to give approximately 5 cm amplitude.
4. Set all trimmers on the CH1 amplifier, trigger amplifier and Y output printed circuit boards to approximately mid position, except C217 and C220 (Fig. 3) which should be set to minimum capacitance.

NOTE

Be sure that the instrument has had at least 30 minutes warm-up before proceeding.

5. Adjust C420 (Fig. 2) to extend the flat top of the **second** pulse towards the leading edge.
6. Adjust C217 (Fig. 2) to extend the flat portion towards the edge.
7. Set TIME/CM to 20 μs and observing the second positive-going corner, adjust C421 (Fig. 3) to extend the flat portion towards the edge, giving priority to straightness even if a slope appears.

8. Adjust C411 (Fig. 2) to extend the flat portion towards the edge maintaining the straightness, then set CH1 VOLTS/CM VARIABLE to CAL and adjust the generator to give 7 cm amplitude.*
9. Adjust C211 (Fig. 3) to extend that flat portion towards the edge, then push in the PULL X10 control.
10. Re-adjust C420 and C421 (Fig. 2) if necessary, to remove any slope and to square the corner.
11. Set CH1 VOLTS/CM to 10 mV and adjust the 50 Ω attenuator pad and generator to obtain 7 cm amplitude and adjust C209 (Fig. 3) for a square corner.
12. Set CH1 VOLTS/CM to 20 mV and reset input amplitude then adjust C210 (Fig. 3) for a square corner.
13. Set CH1 VOLTS/CM to 5 mV and apply a constant amplitude signal from the RF Sine Wave Signal Generator to the CH1 input connector via a 50 ohm termination. Set the frequency of the generator to 500 kHz approximately, and amplitude to give exactly 6 cm of display. Increase the frequency until the indicated amplitude is 4.2 cm and ensure that the frequency is greater than 20 MHz.*

NOTE

To increase frequency, apply Square Wave Generator on 5 mV/cm range then adjust C411 (Fig. 2) to give some overshoot, then adjust C421 (Fig. 2) and C217 (Fig. 3) to give a square corner. Repeat (13). To reduce frequency, adjust C411 to give some undershoot, then adjust C421 and C217 for a square corner. Repeat (13).

14. Switch off CH1 and set CH2 position control to mid range.
15. Set
    (a) CH2 VOLTS/CM to 5 mV
    (b) CH2 VOLTS/CM VARIABLE fully counterclockwise
    (c) TRIG SELECT to CH2 +
    (d) TIME/CM to 0.5 μs
    and apply a fast rise time square wave to CH2 input.
16. Obtain 7 cm amplitude of display, then
    (a) Adjust C220 (Fig. 3) to give a square corner.
    (b) Set CH2 VOLTS/CM VARIABLE to CAL.
    (c) Reset generator to give 7 cm amplitude.
    (d) Adjust C215 (Fig. 3) to give a square corner
17. Set CH2 VOLTS/CM to 10 mV and generator to obtain 7 cm amplitude and then adjust C213 (Fig. 3) for a square corner.
18. Set CH2 VOLTS/CM to 20 mV, then reset generator and adjust C214 (Fig. 3) for a square corner.
19. Apply a constant amplitude signal from the RF Sine Wave Generator to the CH2 input socket via a 50 Ω termination with the CH2 VOLTS/CM at 5 mV.
    (a) Set the generator frequency to 500 kHz range and amplitude to give cm of display.
    (b) Increase the frequency until the indicated amplitude is 5 cm and ensure that this frequency is greater than 20 MHz

*The amplifier response may be limited with C411 to 20 MHz to mask variations of pulse response with range switching.

5-14. HIGH FREQUENCY TRIGGERING

1. Increase the frequency of the generator to 20 MHz and adjust the amplitude of 1 cm and pull out the PULL X10 control to give 50 ns/cm sweep rate. Adjust the LEVEL control to obtain a stable cleanly triggered waveform.
2. Set
    (a) CH1 position control to mid range
    (b) TRIG SELECT to CH1 + and apply the sine wave signal to the CH1 input BNC. Obtain 1 cm of stable triggered waveform by adjustment of the LEVEL control.

5-15. CASCADE

1. Set the RF Sine Wave Generator to 500 kHz, the TIME/CM to 0.5 μs, TRIG SELECT to CH2 + and apply the generator to CH2 input.
2. Adjust the amplitude of the generator to give exactly 4 cm deflection and turn CH2 Position control to OFF.
3. Set CH2 VOLTS/CM to 20 mV and connect the CH2 OUT to the CH1 input socket with the short 12249A cable. Ensure that the CH1 display is a clean sine wave of amplitude between 4.8 cm and 5.2 cm.
4. Adjust the generator to give exactly 7 cm of CH1 AC coupled display then increase the frequency until the indicated amplitude is 5 cm. Ensure that this frequency is greater than 5.5 MHz. Remove the 12249A and reset the CH2 VOLTS/CM switch to 5 mV.
5. Set the CH1 input switch to GND and set the CH1 position control to center the trace on the CRT graticule. Set CH1 input coupling switch to DC and adjust R262 (Fig. 3) recenter the trace.

5-16. X–Y

1. Apply a 1 kHz sine wave signal to the CH2 input BNC and set TIME/CM to 1 ms.
    (a) Adjust the generator to give 5 cm amplitude then apply this signal also to the CH1 input.
    (b) Set the TIME/CM switch to X–Y and position the trace with the X position control so that the X deflection is equal about the vertical center line on the graticule.
    (c) Increase the frequency continuously to 500 kHz and ensure that, if the 45° line gradually changes to an ellipse, the spacing of the lines on the vertical axis does not exceed 2.5 mm over the frequency range. (± 3° phase shift)
2. Set the CH2 input switch to GND and apply a signal from the Constant Amplitude Sine Wave generator at 50 kHz to the X (CH1) input connector.
    (a) Adjust the amplitude to give a horizontal line 10 cm long.
    (b) Increase frequency until trace reduces to 7 cm and ensure that this frequency is greater than 1 MHz.

5-17. EXT X

1. Apply the 50 kHz sine wave from the Constant Amplitude generator to the EXT X BNC with the TIME/CM switch set to EXT X and the PULL X10 control 'out'.
   (a) Adjust amplitude to give 10 cm deflection.
   (b) Increase frequency until the trace reduces to 7 cm and ensure that this frequency is greater than 2 MHz.
   (c) Push PULL X10 control 'in'.

5-18. FINAL ADJUSTMENT OF BAL CONTROLS

1. Install the top and bottom covers.
2. Allow a 15 minute warm up period to elapse.
3. Re-adjust the BAL controls.
4. Bring both CH1 and CH2 traces to the center of the screen.
5. Set the SEPARATE CH1 + CH2 switch to CH1 + CH − and check that the combined trace does not move more than 2 cm.
6. Switch back to SEPARATE and pull the PULL TO INV. CH2 knob. The CH2 trace must not move more than 1 cm.

5-19. PACKING INFORMATION

The 1066B is a rugged instrument built to perform in severe environments. If the unit is to be shipped or stored for long periods of time the following packing procedure is recommended:

a) Place the 1066B into an oversize plastic bag and seal the bag.

b) Place the bagged 1066B into a heavy duty corrugated cardboard box. The box must contain at least 2 inches of rubberized hair or equivalent cushion on all six sides of the instrument. The counter must fit snugly into the cushion and the cushion must fit into the box to prevent any movement of the instrument in transit.

c) Place the instruction manual into the box. If accessories are also to be packed put them into a separate plastic bag and pack into the cushion leaving at least two inches of cushion between the instrument and the accessories as well as an extra cushion between accessories and the box.

d) Seal the box fully with 2 or 3 inch wide packing tape.

e) Properly label and address outside of box with a typed label or an indelible pen.

If shipment is to the factory, notify Ballantine in advance and include detailed reasons for return inside box along with your name, firm and full mailing address. Also include your phone number and purchase order number.

Ship prepaid by United Parcel Service or Registered Air Parcel Post to:

Ballantine Laboratories
90 Fanny Road
Post Office Box 97
Boonton, NJ USA 07055

Parts List

The replacement parts listed are available from the vendors listed or from Ballantine Labs.
Your local Ballantine Field Engineering Representative may also carry a stock of parts and can assist you. If pricing quotations are required for parts and or repairs your local representative will give the most rapid service or you may contact the Ballantine Factory directly.

When ordering replacement parts always give the following information:

a) Instrument Model number
b) Serial number
c) Ballantine Part number
d) Schematic Symbol number
e) Identification of the part

Ballantine will do its best to improve the instrument and make changes in style of components and replacement parts. Replacement parts may differ in appearance from those found in your instrument but are always equal or superior in performance. Where necessary minor mechanical modifications may be required. in the replacement of components.

Parts are generally available locally for most replacements. The parts list calls out the recommended vendors where applicable.

The following parts coding are used:

CVC	Capacitor, Variable, Ceramic
CCT	Capacitor, Ceramic, Tubular
CFP	Capacitor, Fixed, Plastic
CCD	Capacitor, Ceramic, Disc
CYF	Capacitor, Mylar, Foil
CMD	Capacitor, Mica, Dipped
CMM	Capacitor, Mica, Molded
CEA	Capacitor, Electrolytic, Aluminum
CET	Capacitor, Electrolytic, Tantalum
DGP	Diode, General Purpose
DZG	Diode, Zener, General Purpose
DRP	Diode, Bridge, Power
FLT	Filter
ICP	Integrated Circuit
TRQ	Transistor
RFF	Resistor, Fixed, Film
RFC	Resistor, Fixed, Composition
RVC	Resistor, Variable, Composition
RFW	Resistor, Fixed, Wirewound
SWG	Switch
LMB	Lamp
TRX	Transformer

Resistors may generally be replaced by Corning Electronics (CGW) type N-55 and C-32. Allen Bradley composition resistors type EB are also used.

CHANNEL 1 ATTENUATOR & INPUT AMPLIFIER CIRCUIT

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C 1	07250000A	CYM 0.1 UF400.0 VK +-20%	56289	418P10404LA3 RADIAL LEAD
C 2	07200000A	CCD 680.0PF 500.0 VK +-10%	71590	CTL CE-681
C 3	07022860A	CMD 39 PF 500 V J 5%	84171	ARCO TYPE DM-15-390-J
C 101	07300000A	CVC .8/6.8PF400. V	73445	C0004EA/6E
C 102	07300000A	CVC .8/6.8PF400. V	73445	C0004EA/6E
C 103	07300000A	CVC .8/6.8PF400. V	73445	C0004EA/6E
C 104	07300000A	CVC .8/6.8PF400. V	73445	C0004EA/6E
C 105	07300000A	CVC .8/6.8PF400. V	73445	C0004EA/6E
C 106	07250080A	CYM 0.01UF400.0 VK +-10%	50423	SEE 07-25001-0A
C 107	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM-103
C 108	07200010A	CCD 6.8PF 150.0 VK +-10%	71590	CTL DD-6R8
C 109	07025041A	CCT 2.7PF T	50423	999 STACKPOLE TYPE GA-SP
D 101	05100000A	DZG 6.2V +-5% 400MW IN753A	12954	DICKSON ELECTRONICS
D 102	05100000A	DZG 6.2V +-5% 400MW IN753A	12954	DICKSON ELECTRONICS
D 103	05100010A	DGP 1N3595	12954	DICKSON ELECTRONICS
D 104	05100010A	DGP 1N3595	12954	DICKSON ELECTRONICS
R 1	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 2	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 3	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 4	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 5	09100001A	RVC 25.0 K 0.5 WM +-20%	50423	ADV 29552
R 51	12121650A	RFF 0047.50 250 MW F +- 1%	16299	COR TYP NA 55
R 101	12026420A	RCF 990.0K 500 MW F+- 1%	03888	PYF TYP TP-500
R 102	12124000A	RFF 0010.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 103	12013920A	RCF 900.0K 500 MW F+- 1%	00656	ARV TYP CPX-1/2
R 104	12125040A	RFF 0110.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 105	12013000A	RCF 1.0M 500 MW F+- 1%	00656	ARV TYP CPX 1/2
R 106	12010150A	RFC 470.0K 500 MW J+- 5%	01121	A-B TYP EB
R 107	12123500A	RFF 3320.00 250 MW F +- 1%	16299	COR TYP NA 55
R 108	12123500A	RFF 3320.00 250 MW F +- 1%	16299	COR TYP NA 55
R 109	12123880A	RFF 8250.00 250 MW F +- 1%	16299	COR TYP NA 55
R 110	12123880A	RFF 8250.00 250 MW F +- 1%	16299	COR TYP NA 55
R 111	12124250A	RFF 0018.2K 250 MW F +- 1%	16299	COR TYP NA 55
R 112	12122500A	RFF 0332.00 250 MW F +- 1%	16299	COR TYP NA 55
R 113	12122500A	RFF 0332.00 250 MW F +- 1%	16299	COR TYP NA 55
R 114	12122000A	RFF 0100.00 250 MW F +- 1%	16299	COR TYP NA 55
S 1	25100000A	SWC DPDT	50423	25869
S 2	25100390A	SWC 1066B SWC WITH POT.R11	50423	PN/29546
SK-A	31033790A	CON UG-1094/U,DAGE	29587	STATE ELECT.PARTS
TR 101	10100000A	TRQ TRANSITOR TYPE UC734	21845	SOLITRON SINGLE
TR 101	10100000A	TRQ TRANSITOR TYPE UC734	21845	SOLITRON SINGLE
TR 102	10100000A	TRQ TRANSITOR TYPE UC734	21845	SOLITRON SINGLE

CHANNEL 2 ATTENUATOR & INPUT AMPLIFIER CIRCUIT

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C 4	07250000A	CYM 0.1 UF400.0 VK +-20%	56289	418P10404LA3 RADIAL LEAD
C 5	07200000A	CCD 680.0PF 500.0 VK +-10%	71590	CTL CE-681
C 6	07022860A	CMD 39 PF 500 V J 5%	84171	ARCO TYPE DM-15-390-J
C 101	07300000A	CVC .8/6.8PF400. V	73445	C0004EA/6E
C 102	07300000A	CVC .8/6.8PF400. V	73445	C0004EA/6E
C 103	07300000A	CVC .8/6.8PF400. V	73445	C0004EA/6E
C 104	07300000A	CVC .8/6.8PF400. V	73445	C0004EA/6E
C 105	07300000A	CVC .8/6.8PF400. V	73445	C0004EA/6E
C 106	07250010A	CYM .01UF400.0 VK +-10%	56289	418P10396KA3
C 107	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM-103
C 108	07200010A	CCD 6.8PF 150.0 VK +-10%	71590	CTL DD-6R8
C 109	07025041A	CCT 2.7PF T	50423	999 STACKPOLE TYPE GA-SP
D 101	05100000A	DZG 6.2V +-5% 400MW IN753A	12954	DICKSON ELECTRONICS
D 102	05100000A	DZG 6.2V +-5% 400MW IN753A	12954	DICKSON ELECTRONICS
D 103	05100010A	DGP 1N3595	12954	DICKSON ELECTRONICS
D 104	05100010A	DGP 1N3595	12954	DICKSON ELECTRONICS
R 6	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 7	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 8	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 9	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 10	09100001A	RVC 25.0 K 0.5 WM +-20%	50423	ADV 29552
R 52	12121650A	RFF 0047.50 250 MW F +- 1%	16299	COR TYP NA 55
R 101	12026420A	RCF 990.0K 500 MW F+- 1%	03888	PYF TYP TP-500
R 102	12124000A	RFF 0010.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 103	12013920A	RCF 900.0K 500 MW F+- 1%	00656	ARV TYP CPX-1/2
R 104	12125040A	RFF 0110.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 105	12013000A	RCF 1.0M 500 MW F+- 1%	00656	ARV TYP CPX 1/2
R 106	12010150A	RFC 470.0K 500 MW J+- 5%	01121	A-B TYP EB
R 107	12123500A	RFF 3320.00 250 MW F +- 1%	16299	COR TYP NA 55
R 108	12123500A	RFF 3320.00 250 MW F +- 1%	16299	COR TYP NA 55
R 109	12123880A	RFF 8250.00 250 MW F +- 1%	16299	COR TYP NA 55
R 110	12123880A	RFF 8250.00 250 MW F +- 1%	16299	COR TYP NA 55
R 111	12124250A	RFF 0018.2K 250 MW F +- 1%	16299	COR TYP NA 55
R 112	12122500A	RFF 0332.00 250 MW F +- 1%	16299	COR TYP NA 55
R 113	12122500A	RFF 0332.00 250 MW F +- 1%	16299	COR TYP NA 55
R 114	12122000A	RFF 0100.00 250 MW F +- 1%	16299	COR TYP NA 55
S 3	25100000A	SWC DPDT	50423	25869
S 4	25100390A	SWC 1066B SWC WITH POT.R11	50423	PN/29546
SK-B	31033790A	CON UG-1094/U.DAGE	29587	STATE ELECT.PARTS
TR 101	10100000A	TRQ TRANSITOR TYPE UC734	21845	SOLITRON SINGLE
TR 102	10100000A	TRQ TRANSITOR TYPE UC734	21845	SOLITRON SINGLE

Y AMPLIFIER & TRIGGER CIRCUIT

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C 7	07101380A	CMD 6.8PF 500. VK+-10%	84171	ARCO DM-15-068K SILVERED
C 9	07095520A	CCD 100 PF 1 KV K 10%	84171	ARC TYP CCD-101
C 10	07095520A	CCD 100 PF 1 KV K 10%	84171	ARC TYP CCD-101
C 201	07095790A	CCD 1 NF 150 V K 10%	71590	CTL TYP CE-102
C 202	07025020A	CCT 1.5PF T	78488	STACKPOLE TYPE GA-3
C 203	07025020A	CCT 1.5PF T	78488	STACKPOLE TYPE GA-3
C 204	07095790A	CCD 1 NF 150 V K 10%	71590	CTL TYP CE-102
C 205	07095790A	CCD 1 NF 150 V K 10%	71590	CTL TYP CE-102
C 206	07025020A	CCT 1.5PF T	78488	STACKPOLE TYPE GA-3
C 207	07025020A	CCT 1.5PF T	78488	STACKPOLE TYPE GA-3
C 208	07095790A	CCD 1 NF 150 V K 10%	71590	CTL TYP CE-102
C 209	07300010A	CVC 5.5/25PF350. V	72982	TYP 538-014,D,5.5-25
C 210	07300020A	CVC 10/40PF250. V	50423	TYP 10S-TRIKO-06 (S-T)
C 211	07300020A	CVC 10/40PF250. V	50423	TYP 10S-TRIKO-06 (S-T)
C 212	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DD-
C 213	07300010A	CVC 5.5/25PF350. V	72982	TYP 538-014,D,5.5-25
C 214	07300020A	CVC 10/40PF250. V	50423	TYP 10S-TRIKO-06 (S-T)
C 215	07300020A	CVC 10/40PF250. V	50423	TYP 10S-TRIKO-06 (S-T)
C 216	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DD-
C 217	07300020A	CVC 10/40PF250. V	50423	TYP 10S-TRIKO-06 (S-T)
C 218	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DD-
C 219	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DD-
C 220	07300020A	CVC 10/40PF250. V	50423	TYP 10S-TRIKO-06 (S-T)
C 221	07200020A	CCD 30.0PF 500.0 VK +-10%	71590	CTL DD-390
C 222	07200030A	CCD 47.0PF 500.0 VK +-10%	71590	CTL DD-470
C 224	07200020A	CCD 30.0PF 500.0 VK +-10%	71590	CTL DD-390
C 225	07200030A	CCD 47.0PF 500.0 VK +-10%	71590	CTL DD-470
C 226	07200030A	CCD 47.0PF 500.0 VK +-10%	71590	CTL DD-470
C 227	07200060A	CCD 22.0PF 500.0 VK +-10%	71590	CTL DD-220
C 228	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DD-
C 229	07101430A	CEA 75.0UF 12.0 V	56289	500D756G012CC7
C 230	07250020A	CYM .47UF160.0 VK +-10%	56289	418P47492MA3
C 232	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DD-
C 233	07101440A	CYM 33.0NF 200.0 V	56289	418P333921KA3 RADIAL LEA
C 234	07101420A	CEA 0.1 UF160.0 VK +-10%	50423	
C 235	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DD-
C 236	07250030A	CEA 1.0 UF160.0 VK +-10%	73445	C296AB/A1M
C 237	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DD-
C 238	07200040A	CCD 27.0PF 500.0 VK +-10%	71590	CTL DD-270
C 239	07200050A	CCD 0.1UF 30.0 VK +-10%	71590	CTL CK-104
C 240	07200060A	CCD 22.0PF 500.0 VK +-10%	71590	CTL DD-220
C 241	07200070A	CCD 56.0PF 500.0 VK +-10%	71590	CTL DD-560
C 242	07200070A	CCD 56.0PF 500.0 VK +-10%	71590	CTL DD-560
C 243	07200030A	CCD 47.0PF 500.0 VK +-10%	71590	CTL DD-470
C 244	07200060A	CCD 22.0PF 500.0 VK +-10%	71590	CTL DD-220
C 245	07095580A	CCD 33.0PF 500.0VK +-10%	50423	SPG TYP C030B102G330K
C 246	07095510A	CCD 10 PF 1 KV K 10%	84171	ARC TYP CCD-100
C 247	07095510A	CCD 10 PF 1 KV K 10%	84171	ARC TYP CCD-100
C 248	07022920A	CMM 470 PF 500 V J 5%	84171	ARCO DM-15-471-J
C 248	07250120A	CSM 470.0 PF500.0 K +-51%	50423	SEE 07-02292-0A
C 249	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DD-
C 250	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DD-
C 251	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DD-
C 252	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DD-
C 253	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DD-
C 254	07095580A	CCD 33.0PF 500.0VK +-10%	50423	SPG TYP C030B102G330K
C 255	07095580A	CCD 33.0PF 500.0VK +-10%	50423	SPG TYP C030B102G330K
C 256	07200050A	CCD 0.1UF 30.0 VK +-10%	71590	CTL CK-104
D 201	05079120A	DZP 109 V +-5%	27832	HUGHES
D 202	05079120A	DZP 109 V +-5%	27832	HUGHES
D 203	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 204	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 205	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 206	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 207	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 208	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 209	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS

Y AMPLIFIER & TRIGGER CIRCUIT (Continued)

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
D 210	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 211	05100440A	DZG 3.9 V 400. MW IN3508	12954	DICKSON IN3508 OR MOT EQ
D 212	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 213	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 214	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 215	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 216	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 217	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 218	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 219	05100050A	DZG 2.7V +-5% 400MW 1N4371A	12954	DICKSON ELECTRONICS
D 220	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 221	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 222	05100450A	DZG 3.3 V 400. MW IN3506	12954	DICKSON IN3506 OR MOT EQ
D 223	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 224	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 225	05100450A	DZG 3.3 V 400. MW IN3506	12954	DICKSON IN3506 OR MOT EQ
D 226	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 228	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 229	05100000A	DZG 6.2V +-5% 400MW IN753A	12954	DICKSON ELECTRONICS
F 2	19100000A	FUS .063 A 125 V 3AG	71400	BUS GFA 1/16 7591
L 1	46100000A	FRB FERRITE BEAD	78488	STACKPOLE 57-0180-7D MAT
L 2	46100000A	FRB FERRITE BEAD	78488	STACKPOLE 57-0180-7D MAT
L 5	03100210A	CRF 10UH INDUCTOR,PEAKING	83125	NYTRONICS DD-10.0
L 6	03100210A	CRF 10UH INDUCTOR,PEAKING	83125	NYTRONICS DD-10.0
R 11	09100010A	RVC 500.0 0.5 WK +-10%	73138	HEL TYP 72PM
R 12	09100010A	RVC 500.0 0.5 WK +-10%	73138	HEL TYP 72PM
R 15	12150000A	RCF 82.00K 1.00WJ +-5%	01121	ALLEN BRADLEY ABGB
R 16	12012540A	RFC 27.0K 1 W J+-10%	01121	A-B TYP GB
R 17	09100001A	RVC 25.0 K 0.5 WM +-20%	50423	ADV 29552
R 201	12123080A	RFF 1210.00 250 MW F +- 1%	16299	COR TYP NA 55
R 202	12122240A	RFF 0178.00 250 MW F +- 1%	16299	COR TYP NA 55
R 203	12123080A	RFF 1210.00 250 MW F +- 1%	16299	COR TYP NA 55
R 204	12121500A	RFF 0033.20 250 MW F +- 1%	16299	COR TYP NA 55
R 205	12123080A	RFF 1210.00 250 MW F +- 1%	16299	COR TYP NA 55
R 206	12122240A	RFF 0178.00 250 MW F +- 1%	16299	COR TYP NA 55
R 207	12123080A	RFF 1210.00 250 MW F +- 1%	16299	COR TYP NA 55
R 208	12122930A	RFF 0931.00 250 MW F +- 1%	16299	COR TYP NA 55
R 209	12122260A	RFF 0187.00 250 MW F +- 1%	16299	COR TYP NA 55
R 210	12123800A	RFF 6810.00 250 MW F +- 1%	16299	COR TYP NA 55
R 211	12123800A	RFF 6810.00 250 MW F +- 1%	16299	COR TYP NA 55
R 212	12122260A	RFF 0187.00 250 MW F +- 1%	16299	COR TYP NA 55
R 213	12122930A	RFF 0931.00 250 MW F +- 1%	16299	COR TYP NA 55
R 214	12122260A	RFF 0187.00 250 MW F +- 1%	16299	COR TYP NA 55
R 215	12123800A	RFF 6810.00 250 MW F +- 1%	16299	COR TYP NA 55
R 216	12123800A	RFF 6810.00 250 MW F +- 1%	16299	COR TYP NA 55
R 217	12122260A	RFF 0187.00 250 MW F +- 1%	16299	COR TYP NA 55
R 218	12122720A	RFF 0562.00 250 MW F +- 1%	16299	COR TYP NA 55
R 219	12122650A	RFF 0475.00 250 MW F +- 1%	16299	COR TYP NA 55
R 220	12122720A	RFF 0562.00 250 MW F +- 1%	16299	COR TYP NA 55
R 221	12122720A	RFF 0562.00 250 MW F +- 1%	16299	COR TYP NA 55
R 222	12122650A	RFF 0475.00 250 MW F +- 1%	16299	COR TYP NA 55
R 223	12122720A	RFF 0562.00 250 MW F +- 1%	16299	COR TYP NA 55
R 224	12122000A	RFF 0100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 225	12122650A	RFF 0475.00 250 MW F +- 1%	16299	COR TYP NA 55
R 226	12122000A	RFF 0100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 227	12123600A	RFF 4220.00 250 MW F +- 1%	16299	COR TYP NA 55
R 228	12123600A	RFF 4220.00 250 MW F +- 1%	16299	COR TYP NA 55
R 229	12122000A	RFF 0100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 230	12122650A	RFF 0475.00 250 MW F +- 1%	16299	COR TYP NA 55
R 231	12122000A	RFF 0100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 232	12122650A	RFF 0475.00 250 MW F +- 1%	16299	COR TYP NA 55
R 233	12121640A	RFF 0046.40 250 MW F +- 1%	16299	COR TYP NA 55
R 234	12123600A	RFF 4220.00 250 MW F +- 1%	16299	COR TYP NA 55
R 235	12123600A	RFF 4220.00 250 MW F +- 1%	16299	COR TYP NA 55
R 236	12121640A	RFF 0046.40 250 MW F +- 1%	16299	COR TYP NA 55

Y AMPLIFIER & TRIGGER CIRCUIT (Continued)

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R 237	12122650A	RFF 0475.00 250 MW F +- 1%	16299	COR TYP NA 55
R 238	12121500A	RFF 0033.20 250 MW F +- 1%	16299	COR TYP NA 55
R 239	12123250A	RFF 1820.00 250 MW F +- 1%	16299	COR TYP NA 55
R 240	12121650A	RFF 0047.50 250 MW F +- 1%	16299	COR TYP NA 55
R 241	12122170A	RFF 0150.00 250 MW F +- 1%	16299	COR TYP NA 55
R 242	09100040A	RVC 100. 0.5 WK +-10%	73138	HEL TYP 72PM
R 243	12123250A	RFF 1820.00 250 MW F +- 1%	16299	COR TYP NA 55
R 244	12123250A	RFF 1820.00 250 MW F +- 1%	16299	COR TYP NA 55
R 245	12121650A	RFF 0047.50 250 MW F +- 1%	16299	COR TYP NA 55
R 246	12122170A	RFF 0150.00 250 MW F +- 1%	16299	COR TYP NA 55
R 247	09100040A	RVC 100. 0.5 WK +-10%	73138	HEL TYP 72PM
R 248	12123250A	RFF 1820.00 250 MW F +- 1%	16299	COR TYP NA 55
R 249	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 250	12122800A	RFF 0681.00 250 MW F +- 1%	16299	COR TYP NA 55
R 251	12121760A	RFF 0061.90 250 MW F +- 1%	16299	COR TYP NA 55
R 252	12123160A	RFF 1470.00 250 MW F +- 1%	16299	COR TYP NA 55
R 253	12123160A	RFF 1470.00 250 MW F +- 1%	16299	COR TYP NA 55
R 254	12121640A	RFF 0046.40 250 MW F +- 1%	16299	COR TYP NA 55
R 255	12121760A	RFF 0061.90 250 MW F +- 1%	16299	COR TYP NA 55
R 256	12122800A	RFF 0681.00 250 MW F +- 1%	16299	COR TYP NA 55
R 257	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 258	12123250A	RFF 1820.00 250 MW F +- 1%	16299	COR TYP NA 55
R 259	12123250A	RFF 1820.00 250 MW F +- 1%	16299	COR TYP NA 55
R 260	12123370A	RFF 2430.00 250 MW F +- 1%	16299	COR TYP NA 55
R 261	12122720A	RFF 0562.00 250 MW F +- 1%	16299	COR TYP NA 55
R 262	09100610A	RVF 2.5K 0.5 W +-30%	73138	HELIPOT 72 CERMET MINI
R 263	12122840A	RFF 0750.00 250 MW F +- 1%	16299	COR TYP NA 55
R 264	12123250A	RFF 1820.00 250 MW F +- 1%	16299	COR TYP NA 55
R 265	12123250A	RFF 1820.00 250 MW F +- 1%	16299	COR TYP NA 55
R 266	12122330A	RFF 0221.00 250 MW F +- 1%	16299	COR TYP NA 55
R 267	12122720A	RFF 0562.00 250 MW F +- 1%	16299	COR TYP NA 55
R 268	12123520A	RFF 3480.00 250 MW F +- 1%	16299	COR TYP NA 55
R 269	12122720A	RFF 0562.00 250 MW F +- 1%	16299	COR TYP NA 55
R 270	12122370A	RFF 0243.00 250 MW F +- 1%	16299	COR TYP NA 55
R 271	12123080A	RFF 1210.00 250 MW F +- 1%	16299	COR TYP NA 55
R 272	12123500A	RFF 3320.00 250 MW F +- 1%	16299	COR TYP NA 55
R 273	12123880A	RFF 8250.00 250 MW F +- 1%	16299	COR TYP NA 55
R 274	12121330A	RFF 0022.10 250 MW F +- 1%	16299	COR TYP NA 55
R 275	12123800A	RFF 6810.00 250 MW F +- 1%	16299	COR TYP NA 55
R 276	12125170A	RFF 0150.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 277	12122000A	RFF 0100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 278	12124880A	RFF 0082.5K 250 MW F +- 1%	16299	COR TYP NA 55
R 281	12125650A	RFF 0475.0K 500 MW F +- 1%	16299	COR TYP NA 60
R 282	12123500A	RFF 3320.00 250 MW F +- 1%	16299	COR TYP NA 55
R 283	12123500A	RFF 3320.00 250 MW F +- 1%	16299	COR TYP NA 55
R 284	12123640A	RFF 4640.00 250 MW F +- 1%	16299	COR TYP NA 55
R 285	12123250A	RFF 1820.00 250 MW F +- 1%	16299	COR TYP NA 55
R 286	12123170A	RFF 1500.00 250 MW F +- 1%	16299	COR TYP NA 55
R 287	12121650A	RFF 0047.50 250 MW F +- 1%	16299	COR TYP NA 55
R 288	12122880A	RFF 0825.00 250 MW F +- 1%	16299	COR TYP NA 55
R 289	12122880A	RFF 0825.00 250 MW F +- 1%	16299	COR TYP NA 55
R 291	12121650A	RFF 0047.50 250 MW F +- 1%	16299	COR TYP NA 55
R 292	12123000A	RFF 1000.00 250 MW F +- 1%	16299	COR TYP NA 55
R 294	12123000A	RFF 1000.00 250 MW F +- 1%	16299	COR TYP NA 55
R 295	12123000A	RFF 1000.00 250 MW F +- 1%	16299	COR TYP NA 55
R 296	12123000A	RFF 1000.00 250 MW F +- 1%	16299	COR TYP NA 55
R 297	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 298	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 299	12125800A	RFF 0681.0K 500 MW F +- 1%	16299	COR TYP NA 60
R 300	12122360A	RFF 0237.00 250 MW F +- 1%	16299	COR TYP NA 55
R 301	12124170A	RFF 0015.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 302	12124650A	RFF 0047.5K 250 MW F +- 1%	16299	COR TYP NA 55
R 304	12123250A	RFF 1820.00 250 MW F +- 1%	16299	COR TYP NA 55
R 305	12124800A	RFF 0068.1K 250 MW F +- 1%	16299	COR TYP NA 55
R 307	12121650A	RFF 0047.50 250 MW F +- 1%	16299	COR TYP NA 55
R 308	12013330A	RCF 2.7K 500 MW F+- 1%	00656	ARV TYP CPX-1/2
R 309	12010480A	RFC 4.7K 500 MW J+- 5%	01121	A-B TYP EB

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R 310	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 311	09100610A	RVF 2.5K 0.5 W +-30%	73138	HELIPOT 72 CERMET MINI
R 312	12123310A	RFF 2100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 313	09100610A	RVF 2.5K 0.5 W +-30%	73138	HELIPOT 72 CERMET MINI
R 314	12123310A	RFF 2100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 315	12122880A	RFF 0825.00 250 MW F +- 1%	16299	COR TYP NA 55
R 316	12122520A	RFF 0348.00 250 MW F +- 1%	16299	COR TYP NA 55
R 317	12122520A	RFF 0348.00 250 MW F +- 1%	16299	COR TYP NA 55
R 318	12122520A	RFF 0348.00 250 MW F +- 1%	16299	COR TYP NA 55
R 319	12122520A	RFF 0348.00 250 MW F +- 1%	16299	COR TYP NA 55
R 320	12122640A	RFF 0464.00 250 MW F +- 1%	16299	COR TYP NA 55
R 321	12123400A	RFF 2610.00 250 MW F +- 1%	16299	COR TYP NA 55
R 322	12123520A	RFF 3480.00 250 MW F +- 1%	16299	COR TYP NA 55
R 323	12127430A	RCF 8.2 M 0.5 WK +-10%	01121	ALLEN BRADLEY ABEB
R 324	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 326	12122000A	RFF 0100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 328	12123640A	RFF 4640.00 250 MW F +- 1%	16299	COR TYP NA 55
R 329	12122880A	RFF 0825.00 250 MW F +- 1%	16299	COR TYP NA 55
R 330	12123560A	RFF 3830.00 250 MW F +- 1%	16299	COR TYP NA 55
R 331	12123520A	RFF 3480.00 250 MW F +- 1%	16299	COR TYP NA 55
R 332	12124320A	RFF 0021.5K 250 MW F +- 1%	16299	COR TYP NA 55
R 333	12121640A	RFF 0046.40 250 MW F +- 1%	16299	COR TYP NA 55
R 334	12121640A	RFF 0046.40 250 MW F +- 1%	16299	COR TYP NA 55
R 335	12122800A	RFF 0681.00 250 MW F +- 1%	16299	COR TYP NA 55
R 336	12122800A	RFF 0681.00 250 MW F +- 1%	16299	COR TYP NA 55
R 337	12123310A	RFF 2100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 338	12123310A	RFF 2100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 339	12123310A	RFF 2100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 340	12123310A	RFF 2100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 341	12122000A	RFF 0100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 342	12122000A	RFF 0100.00 250 MW F +- 1%	16299	COR TYP NA 55
S 2	25100390A	SWC 1066B SWC WITH POT.R11	50423	PN/29546
S 4	25100390A	SWC 1066B SWC WITH POT.R11	50423	PN/29546
S 7	25100000A	SWC DPDT	50423	25869
S 13	25100000A	SWC DPDT	50423	25869
S 15	25100420A	SWC 1066B SWC.SLIDE DP/DT	50423	PN/4069
SK-C	31033790A	CON UG-1094/U,DAGE	29587	STATE ELECT.PARTS
SK-D	31033790A	CON UG-1094/U,DAGE	29587	STATE ELECT.PARTS
S5/S6	25100330F	SWC 1066A TRIG SEL	50423	29545 S5/R17/S6
TR 201	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 202	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 203	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 204	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 205	10100020A	TRQ TRANSISTOR TYPE 2N930	04713	MOTOROLA
TR 206	10100020A	TRQ TRANSISTOR TYPE 2N930	04713	MOTOROLA
TR 207	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 208	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 209	10079340A	TRQ 2N3640	07263	FAIRCHILD
TR 210	10079340A	TRQ 2N3640	07263	FAIRCHILD
TR 211	10079340A	TRQ 2N3640	07263	FAIRCHILD
TR 212	10079340A	TRQ 2N3640	07263	FAIRCHILD
TR 213	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 214	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 215	10079340A	TRQ 2N3640	07263	FAIRCHILD
TR 216	10079340A	TRQ 2N3640	07263	FAIRCHILD
TR 217	10079340A	TRQ 2N3640	07263	FAIRCHILD
TR 218	10079340A	TRQ 2N3640	07263	FAIRCHILD
TR 219	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 220	10100020A	TRQ TRANSISTOR TYPE 2N930	04713	MOTOROLA
TR 221	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 222	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 223	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 224	10100020A	TRQ TRANSISTOR TYPE 2N930	04713	MOTOROLA
TR 225	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA

Y AMPLIFIER & TRIGGER CIRCUIT (Continued)

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
TR 226	1C100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 227	1C100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 228	1C100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 229	1C100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 230	1C100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 231	1C100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA

TIMEBASE & X AMPLIFIER CIRCUIT

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C 11	07250040A	CYM 1.0 UF160.0 VF +-1%	84171	ARCO DM10-010D
C 12	07250050A	CYM 0.1 UF160.0 VF +-1%	84171	ARCO 2MPD104J
C 13	07250060A	CYM 0.01UF160.0 VF +-1%	84171	ARCO DM30-103F
C 14	07250070A	CYM 900.0 PF160.0 VF +-1%	84171	ARCO DM15-911F
C 15	07022890A	CMD 56 PF 500 V T	84171	ARCO DM-15-560J SILVERED
C 16	07300010A	CVC 5.5/25PF350. V	72982	TYP 538-014,D,5.5-25
C 17	07095520A	CCD 100 PF 1 KV K 10%	84171	ARC TYP CCD-101
C 18	07200080A	CCD 18.0PF 150.0 V	71590	CTL DD-180
C 19	07250010A	CYM .01UF400.0 VK +-10%	56289	418P10396KA3
C 20	07250010A	CYM .01UF400.0 VK +-10%	56289	418P10396KA3
C 501	07095580A	CCD 33.0PF 500.0VK +-10%	50423	SPG TYP C030B102G330K
C 502	07101420A	CEA 0.1 UF160.0 VK +-10%	50423	
C 503	07250020A	CYM .47UF160.0 VK +-10%	56289	418P47492MA3
C 504	07200040A	CCD 27.0PF 500.0 VK +-10%	71590	CTL DD-270
C 505	07095520A	CCD 100 PF 1 KV K 10%	84171	ARC TYP CCD-101
C 506	07200080A	CCD 18.0PF 150.0 V	71590	CTL DD-180
C 507	07200030A	CCD 47.0PF 500.0 VK +-10%	71590	CTL DD-470
C 508	07200080A	CCD 18.0PF 150.0 V	71590	CTL DD-180
C 509	07095520A	CCD 100 PF 1 KV K 10%	84171	ARC TYP CCD-101
C 510	07095510A	CCD 10 PF 1 KV K 10%	84171	ARC TYP CCD-100
C 512	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM-103
C 514	07250000A	CYM 0.1 UF400.0 VK +-20%	56289	418P10404LA3 RADIAL LEAD
C 515	07200050A	CCD 0.1UF 30.0 VK +-10%	71590	CTL CK-104
C 516	07200050A	CCD 0.1UF 30.0 VK +-10%	71590	CTL CK-104
C 517	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM-103
C 518	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM-103
C 511	07101390A	CSD 12.0PF 300.0 VK +-10%	84171	ARCO CCD-120
C 513	07101400A	CSF 390.0PF 50. VK +-10%	25085	SIEMENS 831110A050390K
D 1	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 2	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 501	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 502	05100040A	DGP 0A47	50423	MULLARD ALT. 1N4007
D 503	05100040A	DGP 0A47	50423	MULLARD ALT. 1N4007
D 504	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 505	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 506	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 507	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 508	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 509	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 510	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 511	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 512	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 513	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 514	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 515	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 516	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 517	05100010A	DGP 1N3595	12954	DICKSON ELECTRONICS
D 518	05100000A	DZG 6.2V +-5% 400MW IN753A	12954	DICKSON ELECTRONICS
D 519	05100000A	DZG 6.2V +-5% 400MW IN753A	12954	DICKSON ELECTRONICS
D 520	05079370A	DZQ HV 0667 11 V. +-5%	27832	HUGHES
D 521	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 522	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 523	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 524	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 525	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 526	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 527	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 528	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 529	05100050A	DZG 2.7V +-5% 400MW 1N4371A	12954	DICKSON ELECTRONICS
D530	05079370A	DZQ HV 0667 11 V. +-5%	27832	HUGHES
R 30	12125840A	RFF 0750.0K 500 MW F +- 1%	16299	COR TYP NA 60
R 31	12125800A	RFF 0681.0K 500 MW F +- 1%	16299	COR TYP NA 60
R 32	12125880A	RFF 0825.0K 500 MW F +- 1%	16299	COR TYP NA 60
R 33	12127400A	RFF 150.0 K 1. WJ +-5%	16299	CGW N-70
R 548	12122400A	RFF 0261.00 250 MW F +- 1%	16299	COR TYP NA 55
R 555	12123400A	RFF 2610.00 250 MW F +- 1%	16299	COR TYP NA 55
R 579	12123400A	RFF 2610.00 250 MW F +- 1%	16299	COR TYP NA 55
R 580	12124800A	RFF 0068.1K 250 MW F +- 1%	16299	COR TYP NA 55

TIMEBASE & X AMPLIFIER CIRCUIT (Continued)

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R 18	12124670A	RFF 0049.9K 250 MW F +- 1%	16299	COR TYP NA 55
R 19	12124670A	RFF 0049.9K 250 MW F +- 1%	16299	COR TYP NA 55
R 20	12125000A	RFF 0100.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 21	12125460A	RFF 0301.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 22	12125670A	RFF 0499.0K 500 MW F +- 1%	16299	COR TYP NA 60
R 23	12013000A	RCF 1.0M 500 MW F+- 1%	00656	ARV TYP CPX 1/2
R 24	12150040A	RFF 3.01M 1.00WF +-1%	35929	CONSTANTA CO LTD N3
R 25	12150050A	RFF 4.99M 1.00WF +-1%	35929	CONSTANTA CO LTD N3
R 26	09100121A	RVC 4.70K SWC REV/LOG	50423	CTS 45/DPST ADV.29544
R 27	09100131A	RVC 1K+1K	50423	CTS 45 BACKLASH ADV 2955
R 29	12098380A	RFC 330.0K 250 MW J+- 5%	75042	IRC TYP
R 33	12150010A	RCF 150.0 K 1.00WJ +-5%	01121	ALLEN BRADLEY ABGB
R 34	12010190A	RFC 330.0K 500 MW J+- 5%	01121	A-B TYP EB
R 45	12123500A	RFF 3320.00 250 MW F +- 1%	16299	COR TYP NA 55
R 47	12121650A	RFF 0047.50 250 MW F +- 1%	16299	COR TYP NA 55
R 501	12125650A	RFF 0475.0K 500 MW F +- 1%	16299	COR TYP NA 60
R 502	12124330A	RFF 0022.1K 250 MW F +- 1%	16299	COR TYP NA 55
R 503	12125000A	RFF 0100.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 504	12125330A	RFF 0221.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 505	12122650A	RFF 0475.00 250 MW F +- 1%	16299	COR TYP NA 55
R 506	12125720A	RFF 0562.0K 500 MW F +- 1%	16299	COR TYP NA 60
R 507	12080170A	RFC 330.0 250 MW J+- 5%	01121	A-B TYP CB
R 508	12124500A	RFF 0033.2K 250 MW F +- 1%	16299	COR TYP NA 55
R 509	12124000A	RFF 0010.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 510	12098380A	RFC 330.0K 250 MW J+- 5%	75042	IRC TYP
R 511	12125000A	RFF 0100.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 512	12122170A	RFF 0150.00 250 MW F +- 1%	16299	COR TYP NA 55
R 513	12124650A	RFF 0047.5K 250 MW F +- 1%	16299	COR TYP NA 55
R 514	12123800A	RFF 6810.00 250 MW F +- 1%	16299	COR TYP NA 55
R 515	12122650A	RFF 0475.00 250 MW F +- 1%	16299	COR TYP NA 55
R 516	12123500A	RFF 3320.00 250 MW F +- 1%	16299	COR TYP NA 55
R 517	12124330A	RFF 0022.1K 250 MW F +- 1%	16299	COR TYP NA 55
R 518	12124000A	RFF 0010.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 519	12125650A	RFF 0475.0K 500 MW F +- 1%	16299	COR TYP NA 60
R 520	12124000A	RFF 0010.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 521	12123250A	RFF 1820.00 250 MW F +- 1%	16299	COR TYP NA 55
R 522	12122000A	RFF 0100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 523	12123650A	RFF 4750.00 250 MW F +- 1%	16299	COR TYP NA 55
R 524	12124000A	RFF 0010.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 525	12125000A	RFF 0100.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 526	12123250A	RFF 1820.00 250 MW F +- 1%	16299	COR TYP NA 55
R 527	12124330A	RFF 0022.1K 250 MW F +- 1%	16299	COR TYP NA 55
R 528	12125650A	RFF 0475.0K 500 MW F +- 1%	16299	COR TYP NA 60
R 529	12123000A	RFF 1000.00 250 MW F +- 1%	16299	COR TYP NA 55
R 530	12123570A	RFF 3920.00 250 MW F +- 1%	16299	COR TYP NA 55
R 531	12124080A	RFF 0012.1K 250 MW F +- 1%	16299	COR TYP NA 55
R 532	12124880A	RFF 0082.5K 250 MW F +- 1%	16299	COR TYP NA 55
R 533	12124170A	RFF 0015.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 534	12124650A	RFF 0047.5K 250 MW F +- 1%	16299	COR TYP NA 55
R 535	12122650A	RFF 0475.00 250 MW F +- 1%	16299	COR TYP NA 55
R 536	12123500A	RFF 3320.00 250 MW F +- 1%	16299	COR TYP NA 55
R 537	12123800A	RFF 6810.00 250 MW F +- 1%	16299	COR TYP NA 55
R 538	12122000A	RFF 0100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 539	12123000A	RFF 1000.00 250 MW F +- 1%	16299	COR TYP NA 55
R 540	12122800A	RFF 0681.00 250 MW F +- 1%	16299	COR TYP NA 55
R 541	09100620A	RVC 1.00 K	50423	
R 542	12012180A	RFC 18.0K 2 W J+- 5%	01121	A-B TYP HB
R 543	12123500A	RFF 3320.00 250 MW F +- 1%	16299	COR TYP NA 55
R 544	12123650A	RFF 4750.00 250 MW F +- 1%	16299	COR TYP NA 55
R 545	12012540A	RFC 27.0K 1 W J+-10%	01121	A-B TYP GB
R 546	12122000A	RFF 0100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 547	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 549	12122800A	RFF 0681.00 250 MW F +- 1%	16299	COR TYP NA 55
R 550	12122570A	RFF 0392.00 250 MW F +- 1%	16299	COR TYP NA 55
R 552	09100040A	RVC 100. 0.5 WK +-10%	73138	HEL TYP 72PM
R 553	12150020A	RCF 56.0 K 1.00WJ +-5%	01121	ALLEN BRADLEY ABGB
R 554	12122880A	RFF 0825.00 250 MW F +- 1%	16299	COR TYP NA 55

TIMEBASE & X AMPLIFIER CIRCUIT (Continued)

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R 556	09100060A	RVC 1.0 K 0.5 WK +-10%	73138	HEL TYP 72PM
R 557	12123000A	RFF 1000.00 250 MW F +- 1%	16299	COR TYP NA 55
R 558	12150020A	RCF 56.0 K 1.00WJ +-5%	01121	ALLEN BRADLEY ABGB
R 559	12122880A	RFF 0825.00 250 MW F +- 1%	16299	COR TYP NA 55
R 560	12122000A	RFF 0100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 561	12250000A	RFW 6.8 K 4.0 WJ +-5%	44655	TYP 442-5 NON-INDUCTIVE
R 562	12122720A	RFF 0562.00 250 MW F +- 1%	16299	COR TYP NA 55
R 563	12122650A	RFF 0475.00 250 MW F +- 1%	16299	COR TYP NA 55
R 564	12122000A	RFF 0100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 565	12250000A	RFW 6.8 K 4.0 WJ +-5%	44655	TYP 442-5 NON-INDUCTIVE
R 566	12122720A	RFF 0562.00 250 MW F +- 1%	16299	COR TYP NA 55
R 567	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 568	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 569	12123410A	RFF 2670.00 250 MW F +- 1%	16299	COR TYP NA 55
R 570	12123000A	RFF 1000.00 250 MW F +- 1%	16299	COR TYP NA 55
R 571	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 572	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 573	12123410A	RFF 2670.00 250 MW F +- 1%	16299	COR TYP NA 55
R 574	12125650A	RFF 0475.0K 500 MW F +- 1%	16299	COR TYP NA 60
R 575	12124000A	RFF 0010.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 576	12122000A	RFF 0100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 577	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 578	12123650A	RFF 4750.00 250 MW F +- 1%	16299	COR TYP NA 55
R 581	12124650A	RFF 0047.5K 250 MW F +- 1%	16299	COR TYP NA 55
R582	12123570A	RFF 3920.00 250 MW F +- 1%	16299	COR TYP NA 55
SK-E	31033790A	CON UG-1094/U,DAGE	29587	STATE ELECT.PARTS
SK-F	48100010A	SOC TEFLON FDTHRU TEST PT.	98291	011-2049/GOLD PLATE
SK-K	48100020A	SOC 4MM BLK BANANA JACK	83330	1498
S8/S9	25100290F	SWC 1066A TIME/CM 22P3D/POT	50423	29544 S-8/R26
TR 502	10100040A	TRQ NPN 30V 25W SI MJE520	04713	MOTOROLA
TR 507	10100040A	TRQ NPN 30V 25W SI MJE520	04713	MOTOROLA
TR 510	10100060A	TRQ FET PAIR VC734	21845	SOLITRON VC734
TR 512	10100040A	TRQ NPN 30V 25W SI MJE520	04713	MOTOROLA
TR 513	10100040A	TRQ NPN 30V 25W SI MJE520	04713	MOTOROLA
TR 514	10100040A	TRQ NPN 30V 25W SI MJE520	04713	MOTOROLA
TR 515	10100160A	TRQ TRANSISTOR TYPE 2N5058	07263	FAIRCHILD
TR 517	10100160A	TRQ TRANSISTOR TYPE 2N5058	07263	FAIRCHILD
TR 501	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 503	10100020A	TRQ TRANSISTOR TYPE 2N930	04713	MOTOROLA
TR 504	10100020A	TRQ TRANSISTOR TYPE 2N930	04713	MOTOROLA
TR 505	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 506	10100020A	TRQ TRANSISTOR TYPE 2N930	04713	MOTOROLA
TR 508	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 509	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 511	10100020A	TRQ TRANSISTOR TYPE 2N930	04713	MOTOROLA
TR 516	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 518	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA

BEAM SWITCHING & Y OUTPUT AMPLIFIER CIRCUIT

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C 401	07200060A	CCD 22.0PF 500.0 VK +-10%	71590	CTL DD-220
C 402	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM-103
C 403	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM-103
C 404	07101400A	CSF 390.0PF 50. VK +-10%	25085	SIEMENS 831110A050390K
C 405	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM-103
C 406	07250120A	CSM 470.0 PF500.0 K +-51%	50423	SEE 07-02292-0A
C 407	07200050A	CCD 0.1UF 30.0 VK +-10%	71590	CTL CK-104
C 408	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM-103
C 409	07300020A	CVC 10/40PF250. V	50423	TYP 10S-TRIKO-06 (S-T)
C 410	07200100A	CCD 68.0PF 250.0 VK+-10%	71590	CTL DD-680
C 411	07300020A	CVC 10/40PF250. V	50423	TYP 10S-TRIKO-06 (S-T)
C 412	07095730A	CCD 330 PF 500 V K 10%	71590	CTL TYP CE-331
C 413	07200020A	CCD 30.0PF 500.0 VK +-10%	71590	CTL DD-390
C 414	07200020A	CCD 30.0PF 500.0 VK +-10%	71590	CTL DD-390
C 415	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM-103
C 416	07200020A	CCD 30.0PF 500.0 VK +-10%	71590	CTL DD-390
C 417	07200020A	CCD 30.0PF 500.0 VK +-10%	71590	CTL DD-390
C 418	07095730A	CCD 330 PF 500 V K 10%	71590	CTL TYP CE-331
C 419	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM-103
C 420	07300020A	CVC 10/40PF250. V	50423	TYP 10S-TRIKO-06 (S-T)
C 421	07300020A	CVC 10/40PF250. V	50423	TYP 10S-TRIKO-06 (S-T)
C 422	07095580A	CCD 33.0PF 500.0VK +-10%	50423	SPG TYP C030B102G330K
C 423	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM-103
C 424	07250000A	CYM 0.1 UF400.0 VK +-20%	56289	418P10404LA3 RADIAL LEAD
C 425	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM-103
C 426	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM-103
C 427	07095520A	CCD 100 PF 1 KV K 10%	84171	ARC TYP CCD-101
C 428	07200050A	CCD 0.1UF 30.0 VK +-10%	71590	CTL CK-104
C 429	07200050A	CCD 0.1UF 30.0 VK +-10%	71590	CTL CK-104
C 430	07200060A	CCD 22.0PF 500.0 VK +-10%	71590	CTL DD-220
C 431	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM-103
C 432	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM-103
C 434	07095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM-103
C 435	07200060A	CCD 22.0PF 500.0 VK +-10%	71590	CTL DD-220
C436	07200070A	CCD 56.0PF 500.0 VK +-10%	71590	CTL DD-560
C437	07200060A	CCD 22.0PF 500.0 VK +-10%	71590	CTL DD-220
D 401	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 402	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 403	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 404	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 405	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 406	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 407	05100020A	DGP 1N914	12954	DICKSON ELECTRONICS
L 3	46100000A	FRB FERRITE BEAD	78488	STACKPOLE 57-0180-7D MAT
L 4	46100000A	FRB FERRITE BEAD	78488	STACKPOLE 57-0180-7D MAT
L 401	03100000A	CRF 15 UH	50423	
L 402	03100000A	CRF 15 UH	50423	
R 401	12122650A	RFF 0475.00 250 MW F +- 1%	16299	COR TYP NA 55
R 402	12122000A	RFF 0100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 403	12122800A	RFF 0681.00 250 MW F +- 1%	16299	COR TYP NA 55
R 404	12123250A	RFF 1820.00 250 MW F +- 1%	16299	COR TYP NA 55
R 405	12123650A	RFF 4750.00 250 MW F +- 1%	16299	COR TYP NA 55
R 406	12123650A	RFF 4750.00 250 MW F +- 1%	16299	COR TYP NA 55
R 407	12122000A	RFF 0100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 408	12012540A	RFC 27.0K 1 W J+-10%	01121	A-B TYP GB
R 409	12123880A	RFF 8250.00 250 MW F +- 1%	16299	COR TYP NA 55
R 410	12122650A	RFF 0475.00 250 MW F +- 1%	16299	COR TYP NA 55
R 411	12123250A	RFF 1820.00 250 MW F +- 1%	16299	COR TYP NA 55
R 412	12124330A	RFF 0022.1K 250 MW F +- 1%	16299	COR TYP NA 55
R 413	12121500A	RFF 0033.20 250 MW F +- 1%	16299	COR TYP NA 55
R 414	12122320A	RFF 0215.00 250 MW F +- 1%	16299	COR TYP NA 55
R 415	12121800A	RFF 0068.10 250 MW F +- 1%	16299	COR TYP NA 55
R 416	12122320A	RFF 0215.00 250 MW F +- 1%	16299	COR TYP NA 55
R 417	12123410A	RFF 2670.00 250 MW F +- 1%	16299	COR TYP NA 55
R 418	12123400A	RFF 2610.00 250 MW F +- 1%	16299	COR TYP NA 55
R 419	12121500A	RFF 0033.20 250 MW F +- 1%	16299	COR TYP NA 55
R 420	12121650A	RFF 0047.50 250 MW F +- 1%	16299	COR TYP NA 55
R 422	12122650A	RFF 0475.00 250 MW F +- 1%	16299	COR TYP NA 55
R 423	12123240A	RFF 1780.00 250 MW F +- 1%	16299	COR TYP NA 55

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R 424	12122170A	RFF 0150.00 250 MW F +- 1%	16299	COR TYP NA 55
R 425	12123240A	RFF 1780.00 250 MW F +- 1%	16299	COR TYP NA 55
R 426	09100150A	RVC 5.00K 0.5 WK +-10%	73138	HEL TYP 72PM
R 427	12124080A	RFF 0012.1K 250 MW F +- 1%	16299	COR TYP NA 55
R 428	12122650A	RFF 0475.00 250 MW F +- 1%	16299	COR TYP NA 55
R 429	12124330A	RFF 0022.1K 250 MW F +- 1%	16299	COR TYP NA 55
R 430	12122500A	RFF 0332.00 250 MW F +- 1%	16299	COR TYP NA 55
R 431	12123650A	RFF 4750.00 250 MW F +- 1%	16299	COR TYP NA 55
R 432	12122640A	RFF 0464.00 250 MW F +- 1%	16299	COR TYP NA 55
R 433	12122880A	RFF 0825.00 250 MW F +- 1%	16299	COR TYP NA 55
R 434	12123800A	RFF 6810.00 250 MW F +- 1%	16299	COR TYP NA 55
R 435	12123800A	RFF 6810.00 250 MW F +- 1%	16299	COR TYP NA 55
R 436	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 437	12121880A	RFF 0082.50 250 MW F +- 1%	16299	COR TYP NA 55
R 438	12250010A	RFW 1.5 K 4.0 WJ +-5%	44655	TYP 442-5 NON-INDUCTIVE
R 439	12127410A	RFW 560.0 5.0 WJ +-5%AX	44655	OHMITE TYPE 995 -4613
R 440	12122500A	RFF 0332.00 250 MW F +- 1%	16299	COR TYP NA 55
R 441	12121650A	RFF 0047.50 250 MW F +- 1%	16299	COR TYP NA 55
R 442	12122170A	RFF 0150.00 250 MW F +- 1%	16299	COR TYP NA 55
R 443	12122400A	RFF 0261.00 250 MW F +- 1%	16299	COR TYP NA 55
R 444	12122400A	RFF 0261.00 250 MW F +- 1%	16299	COR TYP NA 55
R 445	12250010A	RFW 1.5 K 4.0 WJ +-5%	44655	TYP 442-5 NON-INDUCTIVE
R 446	12121880A	RFF 0082.50 250 MW F +- 1%	16299	COR TYP NA 55
R 447	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 448	12122880A	RFF 0825.00 250 MW F +- 1%	16299	COR TYP NA 55
R 449	12122500A	RFF 0332.00 250 MW F +- 1%	16299	COR TYP NA 55
R 450	12123650A	RFF 4750.00 250 MW F +- 1%	16299	COR TYP NA 55
R 451	12124000A	RFF 0010.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 452	12124000A	RFF 0010.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 453	12124330A	RFF 0022.1K 250 MW F +- 1%	16299	COR TYP NA 55
R 454	12124000A	RFF 0010.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 455	12121800A	RFF 0068.10 250 MW F +- 1%	16299	COR TYP NA 55
R 456	12122000A	RFF 0100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 457	12121640A	RFF 0046.40 250 MW F +- 1%	16299	COR TYP NA 55
R 458	12123640A	RFF 4640.00 250 MW F +- 1%	16299	COR TYP NA 55
R 459	12123720A	RFF 5620.00 250 MW F +- 1%	16299	COR TYP NA 55
R 460	12123720A	RFF 5620.00 250 MW F +- 1%	16299	COR TYP NA 55
R461	12121800A	RFF 0068.10 250 MW F +- 1%	16299	COR TYP NA 55
S 13	25100400A	SWC 1066B SWC/POT.R13/R14	50423	PN/29551
S 14	25100400A	SWC 1066B SWC/POT.R13/R14	50423	PN/29551
TR 1	10100160A	TRQ TRANSISTOR TYPE 2N5058	07263	FAIRCHILD
TR 2	10100160A	TRQ TRANSISTOR TYPE 2N5058	07263	FAIRCHILD
TR 401	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 402	10100020A	TRQ TRANSISTOR TYPE 2N930	04713	MOTOROLA
TR 403	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 404	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 405	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 406	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 407	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 408	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 409	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 410	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA

POWER SUPPLIES & CRT CIRCUIT

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
C 21	C7101450A	CEA200/200UF250.0 V	56289	62D2538
C 22	C7101450A	CEA200/200UF250.0 V	56289	62D2538
C 23	C7100460A	CMD 300.0PF 50 V +- 5%	84171	ELMENCO TYPE DMEF
C 23	C7101460A	CEA2500.0UF 35.0 V	90201	CG332U035R2C OR FP
C 24	C7100460A	CMD 300.0PF 50 V +- 5%	84171	ELMENCO TYPE DMEFY3C
C 24	C7101460A	CEA2500.0UF 35.0 V	90201	CG332U035R2C OR FP
C 25	C7200120A	CCD 0.01UF 1.5KVK GMK	71590	CTL DD16-103
C 601	C7101490A	CET 47.0UF 25.0 V	56289	SPRAGUE 150D476X903552
C 602	C7101490A	CET 47.0UF 25.0 V	56289	SPRAGUE 150D476X903552
C 603	C7095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM-103
C 604	C7101470A	CEA 1.0UF 350.0 V	56289	500D105F350CC7
C 605	C7101500A	CET 4.7UF 64.0 V	56289	SPRAGUE 150D475X903582
C 606	C7095760A	CCD 10 NF 150 V T 40%	71590	CTL TYP DDM-103
C 607	C7101480A	CEA 4.0UF 450.0 V	56289	500D405F450EH7
C 608	C7101480A	CEA 4.0UF 450.0 V	56289	500D405F450EH7
C 609	C7101480A	CEA 4.0UF 450.0 V	56289	500D405F450EH7
C 610	C7101480A	CEA 4.0UF 450.0 V	56289	500D405F450EH7
C 611	C7101480A	CEA 4.0UF 450.0 V	56289	500D405F450EH7
C 612	C7101480A	CEA 4.0UF 450.0 V	56289	500D405F450EH7
C 613	C7250030A	CEA 1.0 UF160.0 VK +-10%	73445	C296AB/A1M
C 614	C7250110A	CYM .05UF 3.0RVM +-20%	56289	185P473030
C 615	C7250110A	CYM .05UF 3.0RVM +-20%	56289	185P473030
C 616	C7250110A	CYM .05UF 3.0RVM +-20%	56289	185P473030
C 617	C7200110A	CCD4700.0PF 4.0KVK+-10%	50423	
C 618	C7095510A	CCD 10 PF 1 KV K 10%	84171	ARC TYP CCD-100
C21/22	C7100450A	CEA 800. UF 25 V	50423	BRADLEY GC20224
D 11	C5100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 12	C5100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 13	C5100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 601	C5100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 602	C5100080A	DZG 7.5V +-5% 400MW 1N958B	12954	DICKSON ELECTRONICS
D 603	C5100030A	DZG 8.2V +-5% 400MW 1N959B	12954	DICKSON ELECTRONICS
D 604	C5100030A	DZG 8.2V +-5% 400MW 1N959B	12954	DICKSON ELECTRONICS
D 605	C5100080A	DZG 7.5V +-5% 400MW 1N958B	12954	DICKSON ELECTRONICS
D 606	C5100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 607	C5100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 608	C5100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 609	C5100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 614	C5100090A	DZG 180. V +-5% 400MW 1N991B	12954	DICKSON ELECTRONICS
D 615	C5100100A	DGP 1N750A	12954	DICKSON ELECTRONICS
D 616	C5100110A	DGP 1N4007	12954	DICKSON ELECTRONICS
D 617	C5100110A	DGP 1N4007	12954	DICKSON ELECTRONICS
D 618	C5100110A	DGP 1N4007	12954	DICKSON ELECTRONICS
D 619	C5100110A	DGP 1N4007	12954	DICKSON ELECTRONICS
D 620	C5100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 621	C5100120A	DGP HI VOLTAGE SELENIUM	50423	SPECIAL 1066A
D 622	C5100120A	DGP HI VOLTAGE SELENIUM	50423	SPECIAL 1066A
D 623	C5100120A	DGP HI VOLTAGE SELENIUM	50423	SPECIAL 1066A
D 625	C5100020A	DGP 1N914	12954	DICKSON ELECTRONICS
D 626	C5100020A	DGP 1N914	12954	DICKSON ELECTRONICS
FS 1	19100010A	FUS .500 A 250.V	50423	BELLING LEE L1055 GV1710
FS 2	19100000A	FUS .063 A 125 V 3AG	71400	BUS GFA 1/16 7591
ILP 1	16100080A	LMP INDICATOR, NEON TYPE Q	50423	ADV.26586 FOR 1066B
ILP 2	16100010A	LMP 12V @100MA	80795	ITT SGF 1361-D-RD-12
ILP 3	16100010A	LMP 12V @100MA	80795	ITT SGF 1361-D-RD-12
MR 1	C5100060A	DGP BRIDGE RECT. MDA920-6A	04713	MOTOROLA
MR 2	C5100070A	DGP BRIDGE RECT 1N755A	04713	SAME AS 05100070A
MR 3	C5100060A	DGP BRIDGE RECT. MDA920-6A	04713	MOTOROLA
R 35	12124500A	RFF 0033.2K 250 MW F +- 1%	16299	COR TYP NA 55
R 36	12150030A	RCF 47.0 1.00W	01121	ALLEN BRADLEY ABGB
R 37	09100121A	RVC 4.70K SWC REV/LOG	50423	CTS 45/DPST ADV.29544
R 38	09100101A	RVC 100.0 K	50423	CTS 45/DPST ADV 29550
R 39	C9100110A	RVC 1.00M HV INS	50423	ADV. 29549
R 40	12125410A	RFF 0267.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 41	09100140A	RVC 220.00K REV/LOG HV INS	50423	ADV. 29548
R 42	12124000A	RFF 0010.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 43	12010010A	RFC 10.0M 500 MW K+-10%	01121	A-B TYP EB

SCHEMATIC REF	BALLANTINE PART NO.	DESCRIPTION	MFR CODE	MFR PART NUMBER
R 44	12098380A	RFC 330.0K 250 MW J+- 5%	75042	IRC TYP
R 46	12126000A	RFF 1000.0K 500 MW F +- 1%	16299	COR TYP NA 65
R 47	12200000A	RCF 3.30M 2.00WJ +-5%	01121	ALLEN BRADLEY ABGB
R 601	12122000A	RFF 0100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 602	12126000A	RFF 1000.0K 500 MW F +- 1%	16299	COR TYP NA 65
R 603	12121720A	RFF 0056.20 250 MW F +- 1%	16299	COR TYP NA 55
R 604	12124240A	RFF 0017.8K 250 MW F +- 1%	16299	COR TYP NA 55
R 605	12124240A	RFF 0017.8K 250 MW F +- 1%	16299	COR TYP NA 55
R 606	12122800A	RFF 0681.00 250 MW F +- 1%	16299	COR TYP NA 55
R 607	12121720A	RFF 0056.20 250 MW F +- 1%	16299	COR TYP NA 55
R 608	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 609	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 610	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 611	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 612	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 613	12121000A	RFF 0010.00 250 MW F +- 1%	16299	COR TYP NA 55
R 614	09100020A	RVC 5.0 K 0.5 WK +-10%	73138	HEL TYP 72PM
R 614	09100070A	RVC 5.0 K 0.5 WK +-10%	73138	SEE 09100020A
R 615	12123800A	RFF 6810.00 250 MW F +- 1%	16299	COR TYP NA 55
R 616	12123720A	RFF 5620.00 250 MW F +- 1%	16299	COR TYP NA 55
R 617	12125000A	RFF 0100.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 618	12123000A	RFF 1000.00 250 MW F +- 1%	16299	COR TYP NA 55
R 619	12123000A	RFF 1000.00 250 MW F +- 1%	16299	COR TYP NA 55
R 620	12124650A	RFF 0047.5K 250 MW F +- 1%	16299	COR TYP NA 55
R 621	12122000A	RFF 0100.00 250 MW F +- 1%	16299	COR TYP NA 55
R 622	12017110A	RFW 10.0K 5 W F+- 1%	91637	DAL TYP RS-5
R 623	12012580A	RFC 10.0K 1 W J+- 5%	01121	A-B TYP GB
R 624	12122330A	RFF 0221.00 250 MW F +- 1%	16299	COR TYP NA 55
R 625	12092620A	RCF 3.3M 500 MW K+-10%	73445	AMP TYP
R 627	12011110A	RFC 1.8K 500 MW J+- 5%	01121	A-B TYP EB
R 628	09100080A	RVC 10.0 K 0.5 WK +-10%	73138	HEL TYP 72PM
R 629	12124570A	RFF 0039.2K 250 MW F +- 1%	16299	COR TYP NA 55
R 630	12124170A	RFF 0015.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 631	12200000A	RCF 3.30M 2.00WJ +-5%	01121	ALLEN BRADLEY ABGB
R 632	12092720A	RCF 47.0K 500 MW J+- 5%	73445	AMP TYP
R 633	09100620A	RVC 1.00 K	50423	
R 634	12122570A	RFF 0392.00 250 MW F +- 1%	16299	COR TYP NA 55
R 635	12092600A	RCF 1.0M 500 MW K+-10%	73445	AMP TYP
R 636	12125330A	RFF 0221.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 637	12124000A	RFF 0010.0K 250 MW F +- 1%	16299	COR TYP NA 55
R 638	12010480A	RFC 4.7K 500 MW J+- 5%	01121	A-B TYP EB
R 639	09100090A	RVC 250.0 K 0.5 WK +-10%	73138	HEL TYP 72PM
R 640	12011230A	RFC 2.2M 500 MW J+- 5%	01121	A-B TYP EB
R 641	12125000A	RFF 0100.0K 250 MW F +- 1%	16299	COR TYP NA 55
S 10	25100410A	SWC 1066B SWC/POT.R37	50423	PN/A4/29554
S 11	25100420A	SWC 1066B SWC.SLIDE DP/DT	50423	PN/4069
S 12	25100430A	SWC 1066B SWC	50423	29547
SK-G	48100020A	SOC 4MM BLK BANANA JACK	83330	1498
SK-H	48100020A	SOC 4MM BLK BANANA JACK	83330	1498
SK-J	48100020A	SOC 4MM BLK BANANA JACK	83330	1498
TI 1	20100120A	TRX 1066B	50423	A1/35160
TR 3	10094730A	TRQ 2N3906	04713	MOTOROLA
TR 3	10100040A	TRQ NPN 30V 25W SI MJE520	04713	MOTOROLA
TR 4	10100090A	TRQ TRANSISTOR TYPE MPS6519	04713	MOTOROLA
TR 601	10079360A	TRQ 2N3053	86684	RCA OR MOTOROLA
TR 602	10094730A	TRQ 2N3906	04713	MOTOROLA
TR 603	10100020A	TRQ TRANSISTOR TYPE 2N930	04713	MOTOROLA
TR 604	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 605	10100110A	TRQ TRANSISTOR TYPE 2N5831	07263	FAIRCHILD
TR 606	10100010A	TRQ TRANSISTOR TYPE 2N2369	04713	MOTOROLA
TR 607	10100120A	TRQ TRANSISTOR TYPE MJE3439	04713	MOTOROLA
TR 608	10100020A	TRQ TRANSISTOR TYPE 2N930	04713	MOTOROLA
V1	21100030A	TBE CRT 4 kV 8x10 P31	50423	
V1	21100040A	TBE CRT 4 kV 8x10 P7	50423	
	33100000A	POWER CORD		

Notes

Circuit Diagrams

This section contains component location illustrations and schematics for the 1066B. The component location illustrations identify, by reference designation, the location of components shown on the schematics.

All the components shown on the schematics and component location illustrations are described in the parts list in Section 6. Any replacement parts required should be selected from the parts list.

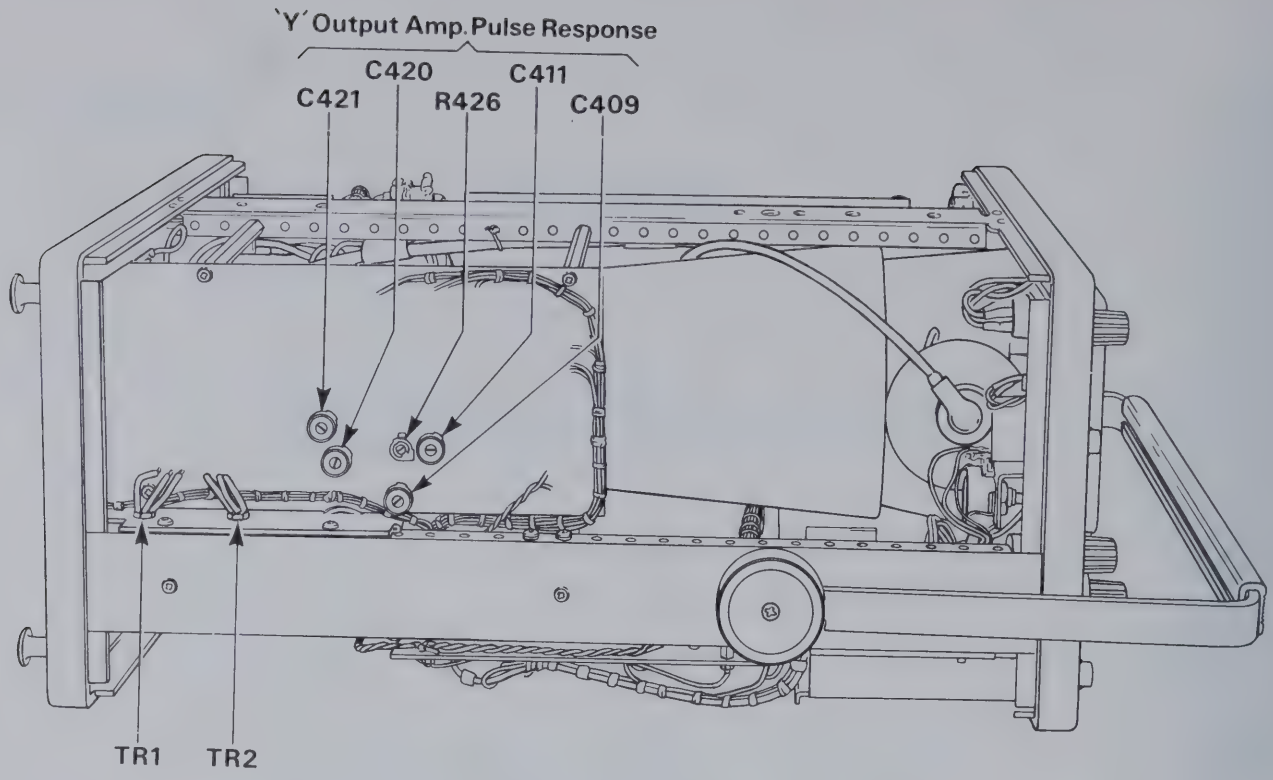


Figure 1. Right-Hand View, Component Locations

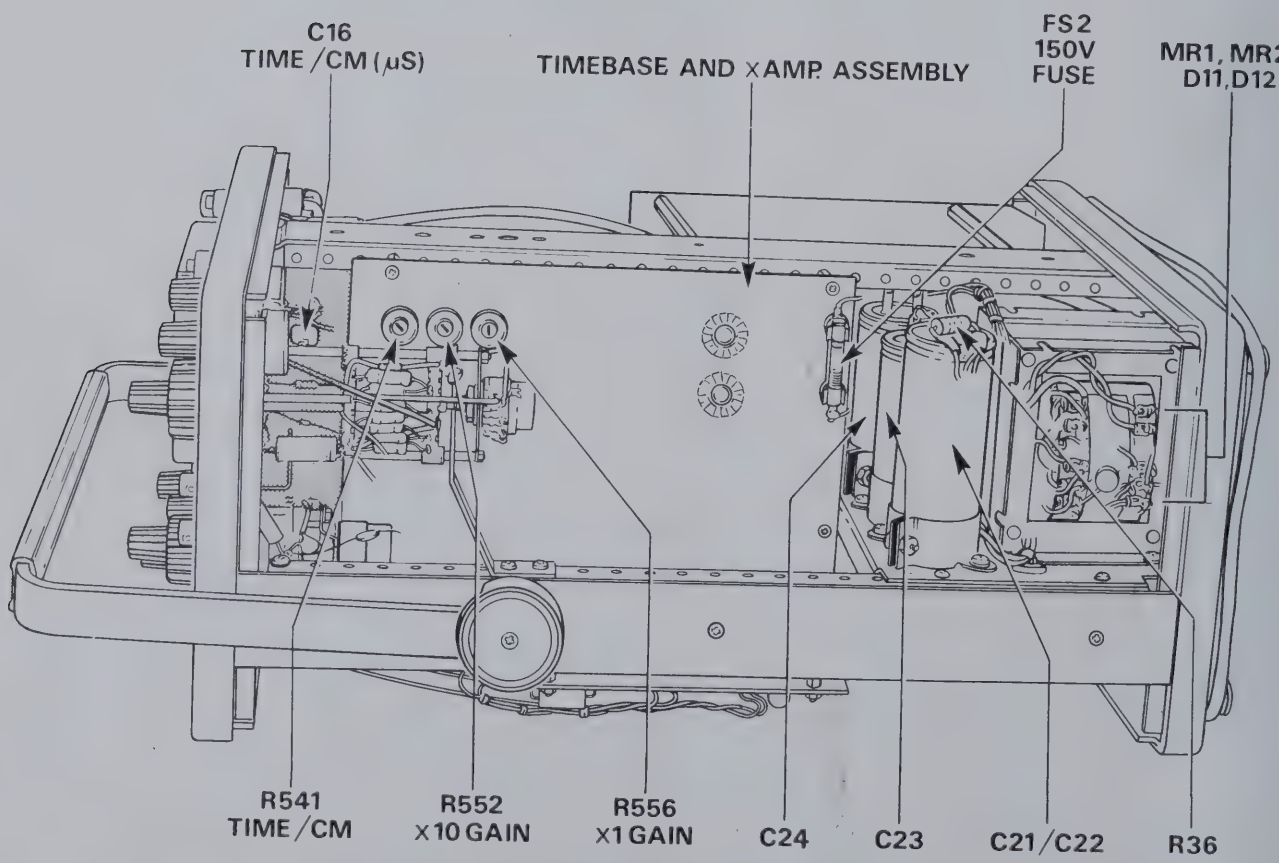


Figure 2. Left-Hand View, Component Locations

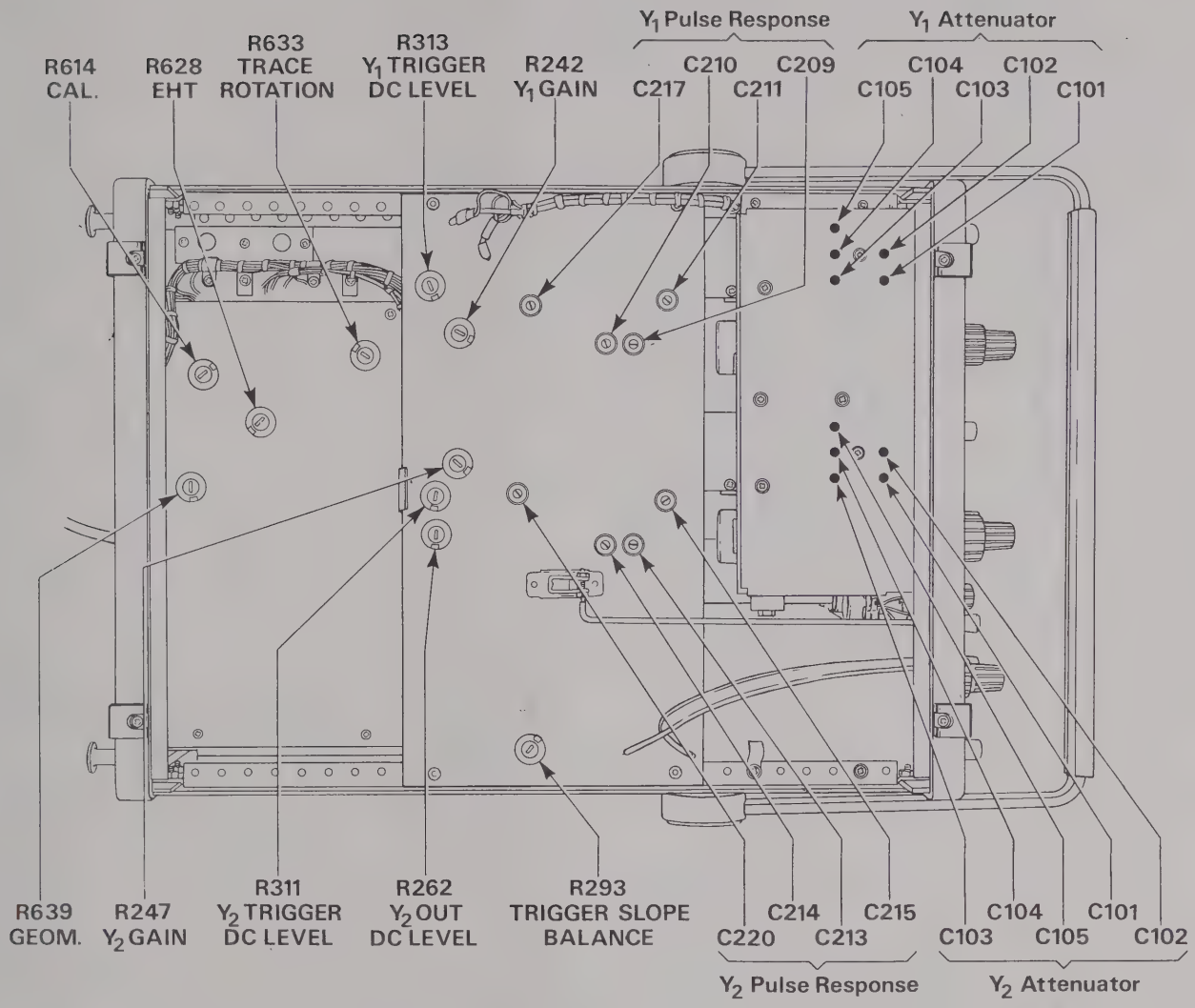


Figure 3. Bottom View, Component Locations

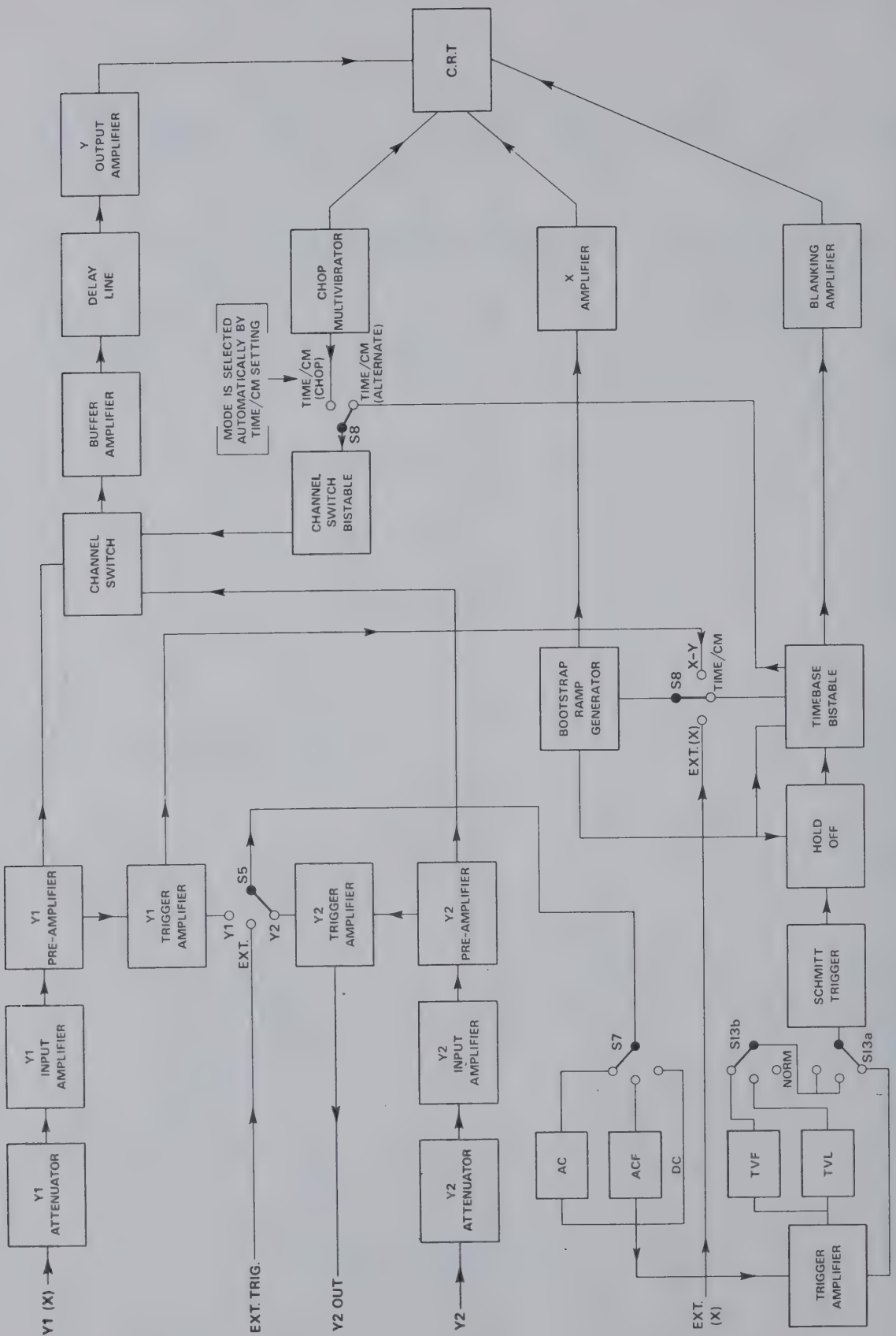
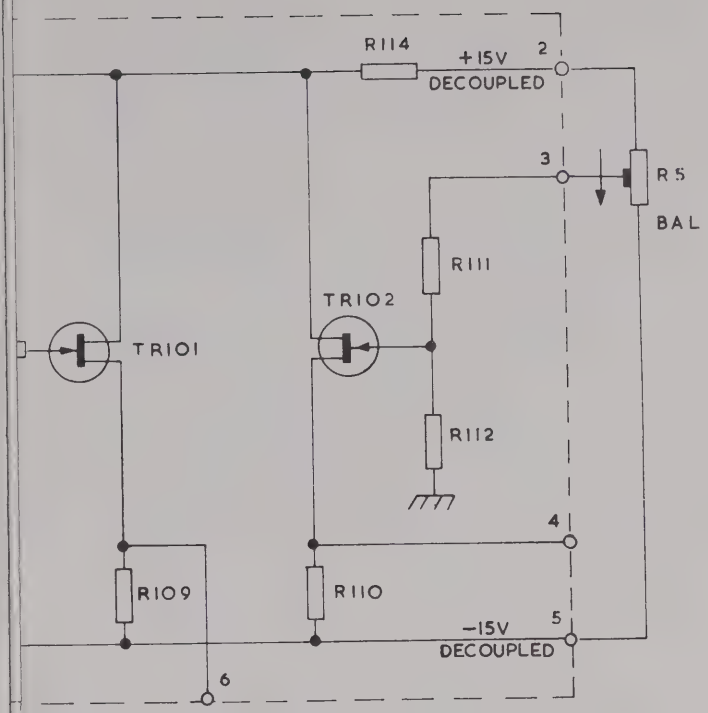


Figure 4. Block Diagram



(a). Channel 1 Attenuator and Input Amplifier Circuit

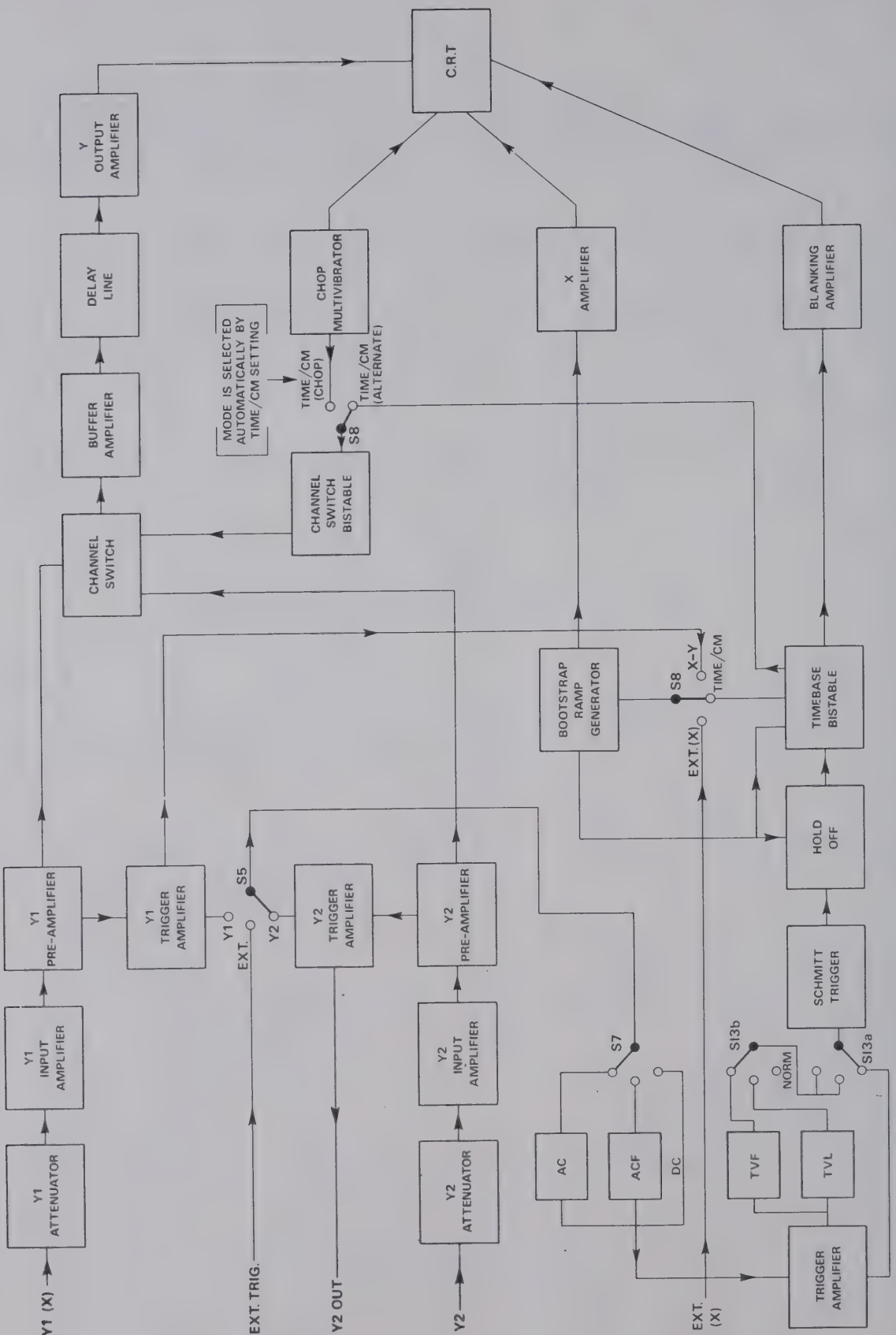


Figure 4. Block Diagram

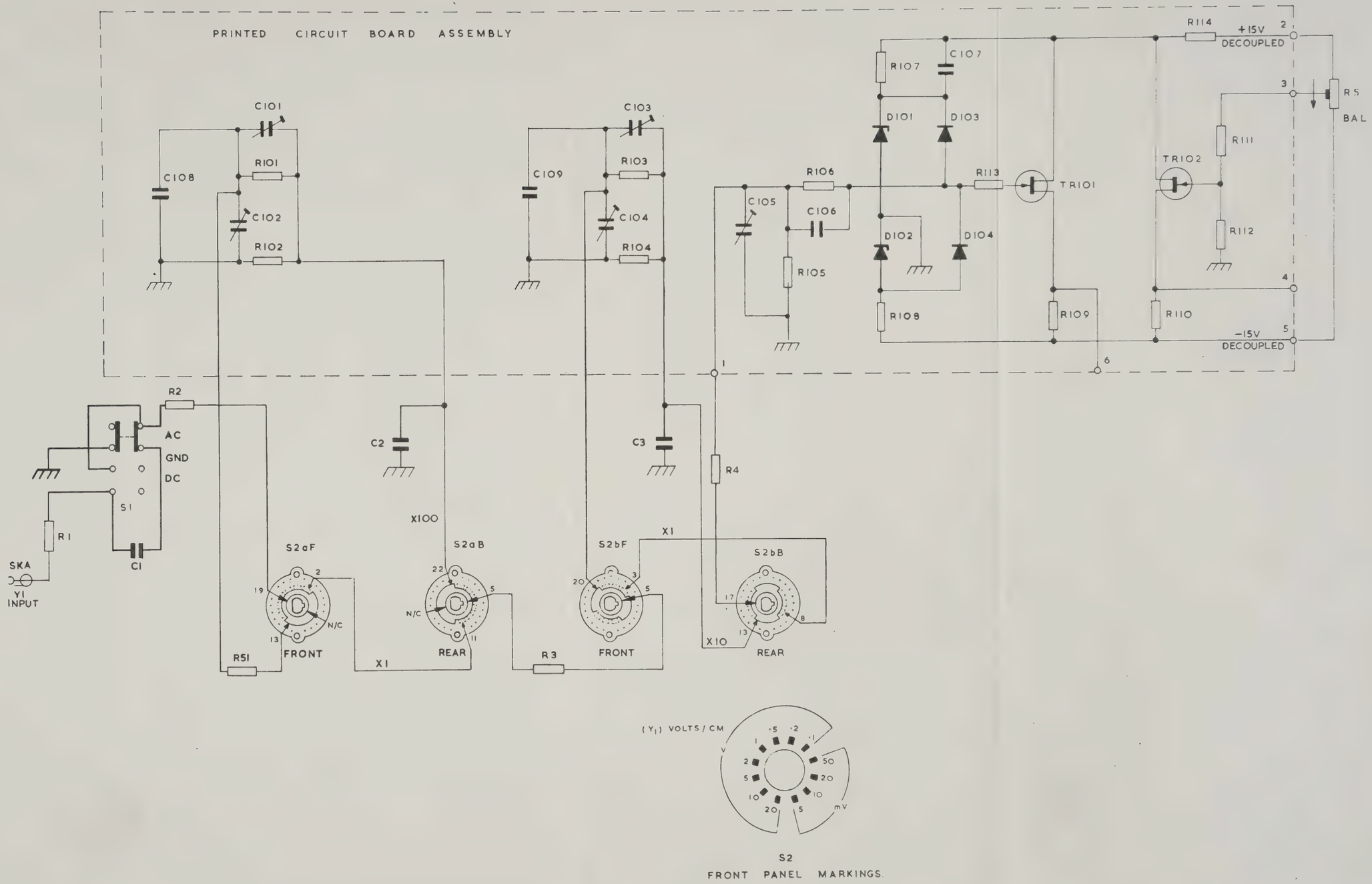


Figure 5(a). Channel 1 Attenuator and Input Amplifier Circuit

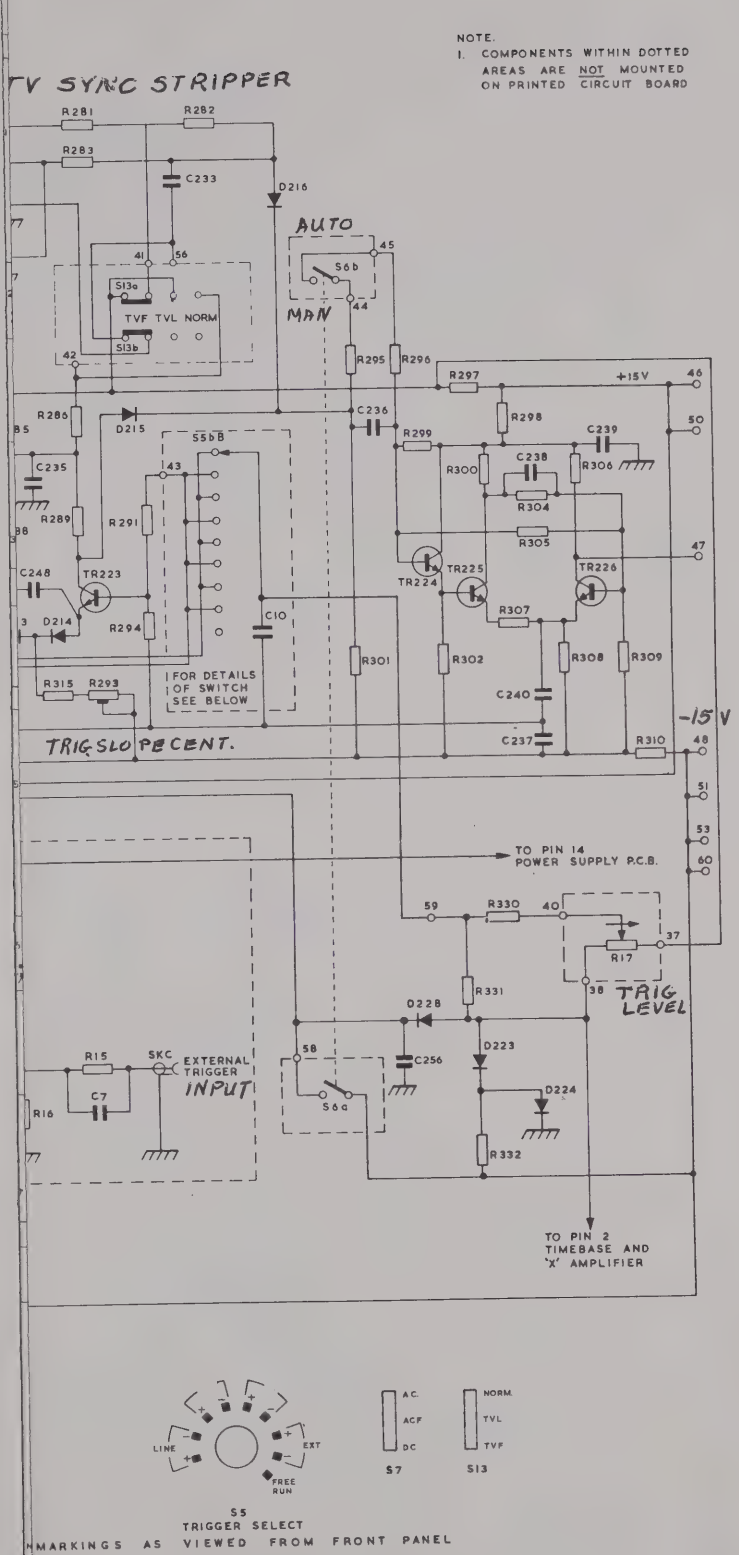
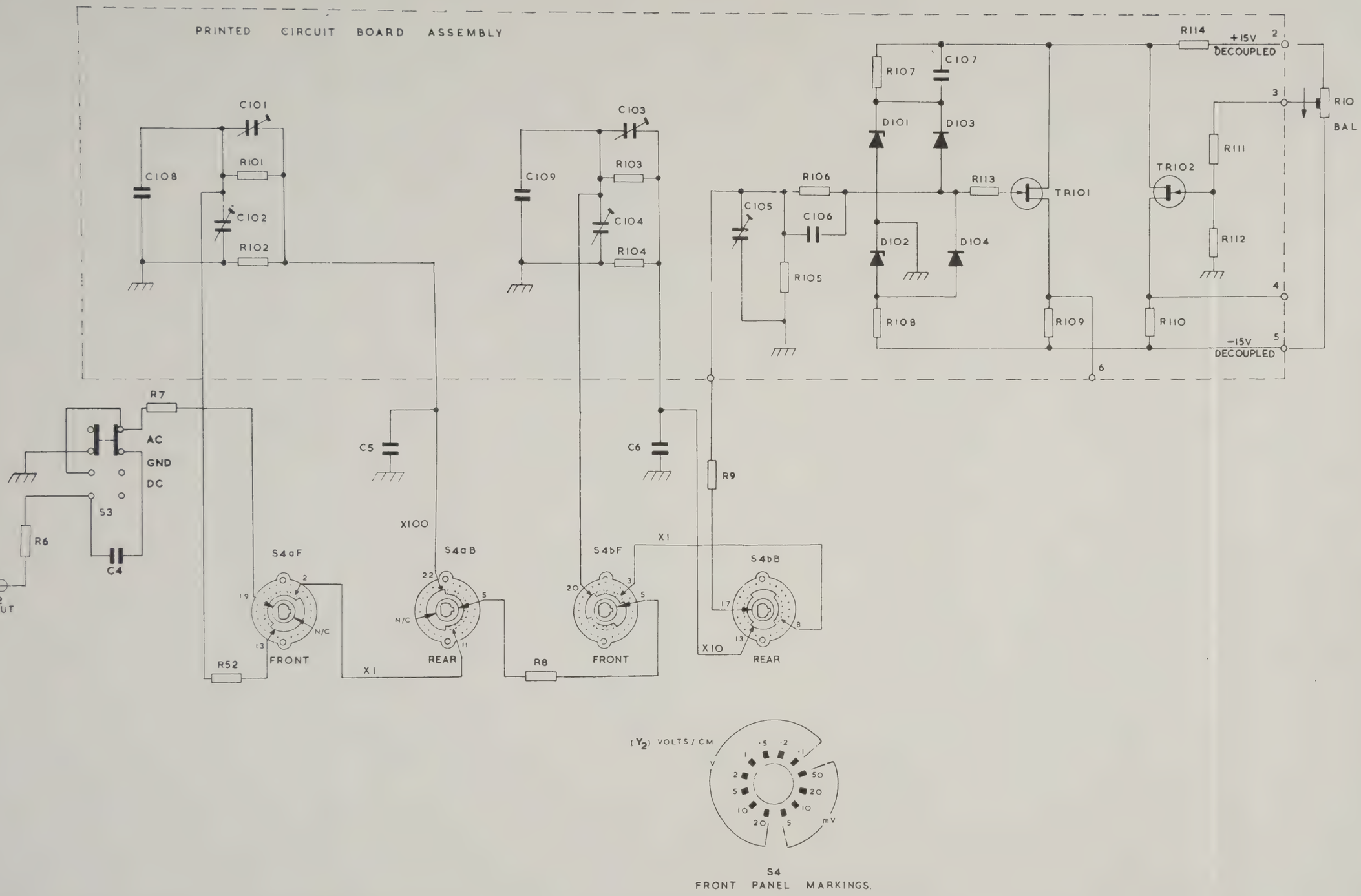
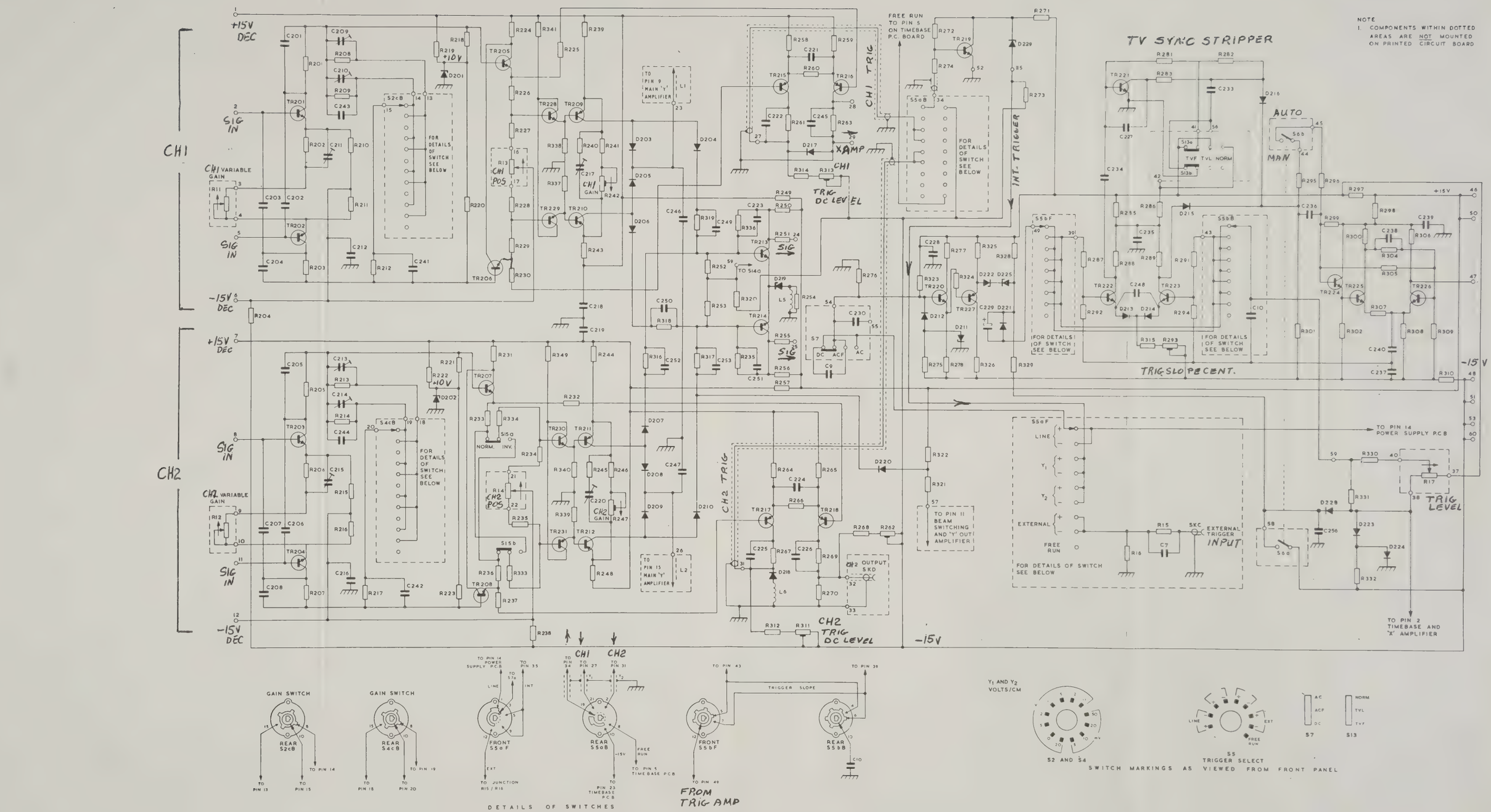


Figure 6. Y Amplifier and Trigger Circuit



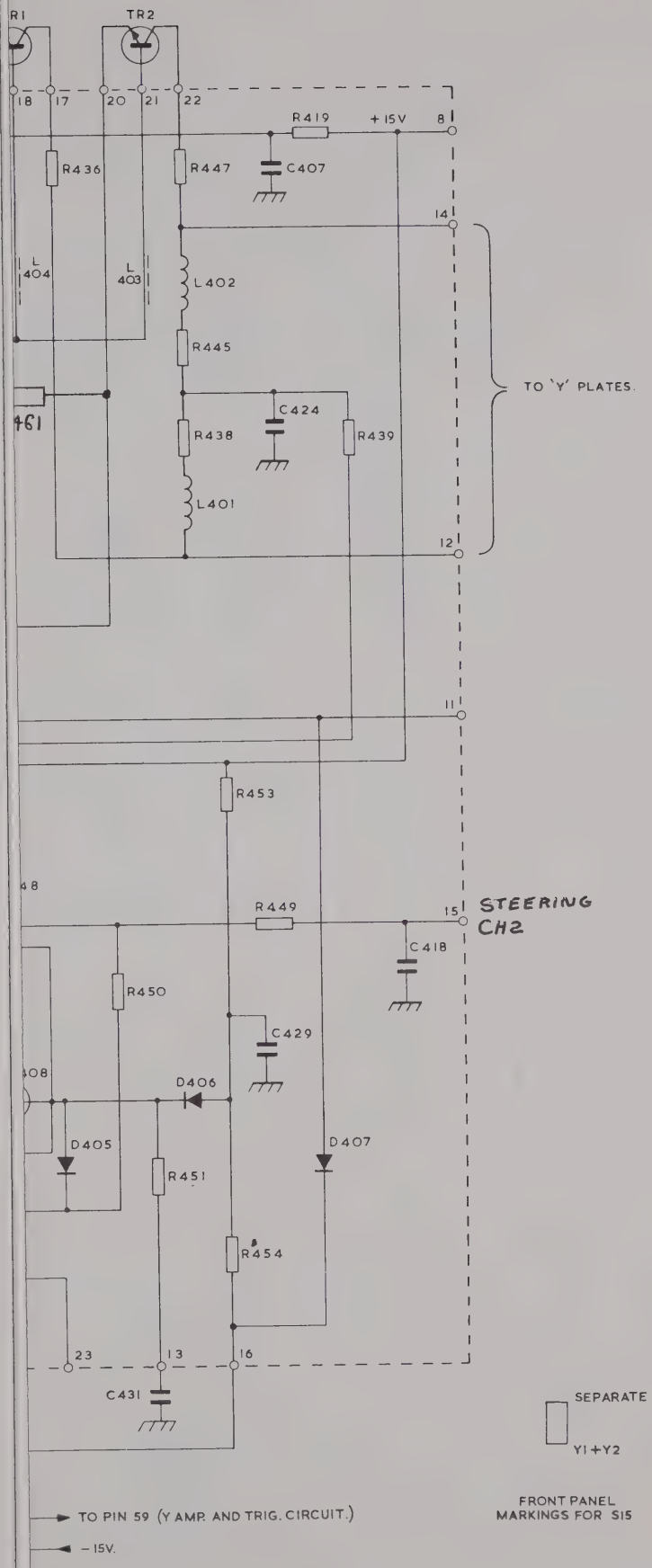
S4
FRONT PANEL MARKINGS.

Figure 5(b). Channel 2 Attenuator and Input Amplifier Circuit



NOTE
1. COMPONENTS WITHIN DOTTED AREAS ARE NOT MOUNTED ON PRINTED CIRCUIT BOARD

Figure 6. Y Amplifier and Trigger Circuit



gure 8. Beam Switching and Y Output Amplifier Circuit

Figure 7. Timebase and X Amplifier Circuit

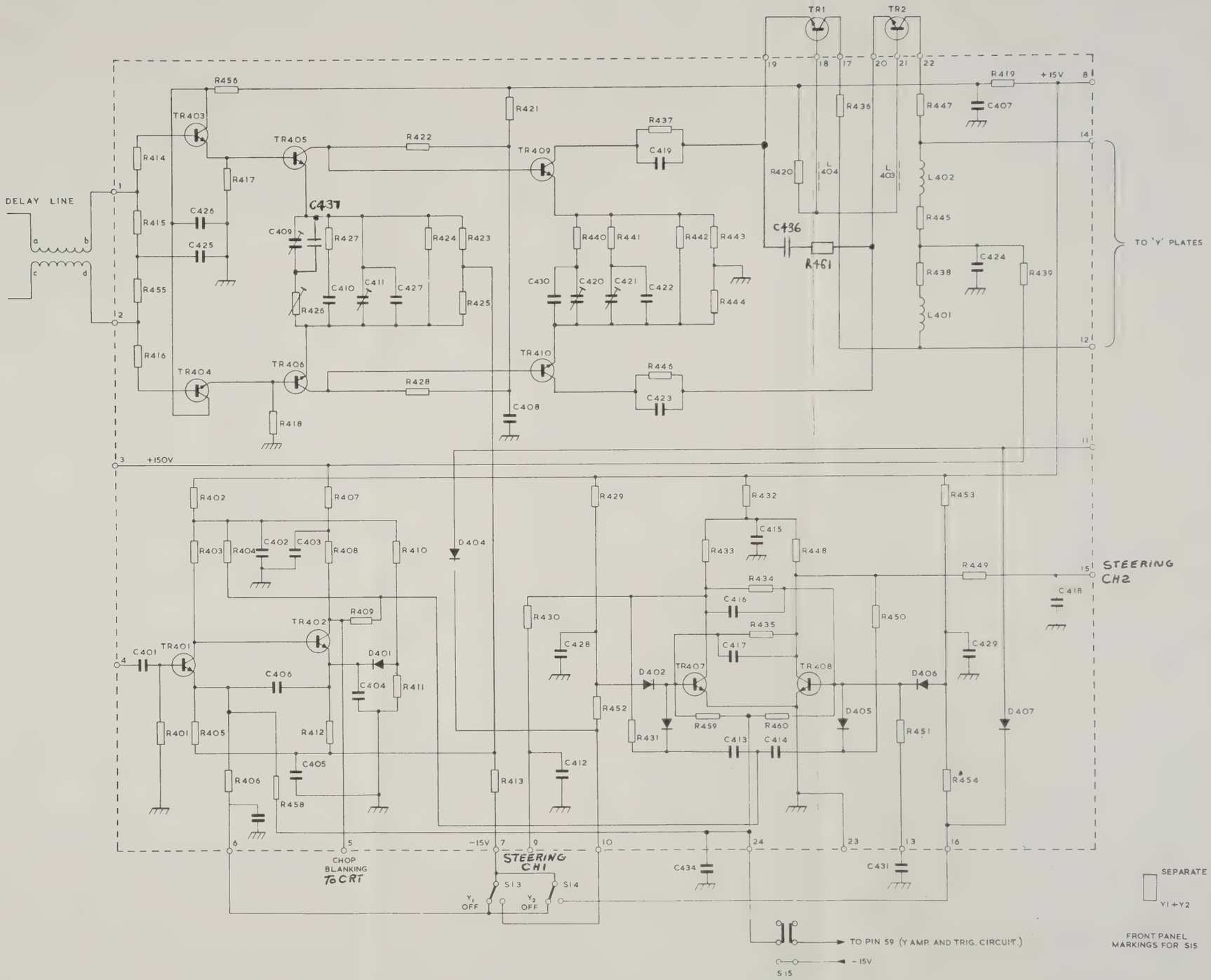


Figure 8. Beam Switching and Y Output Amplifier Circuit

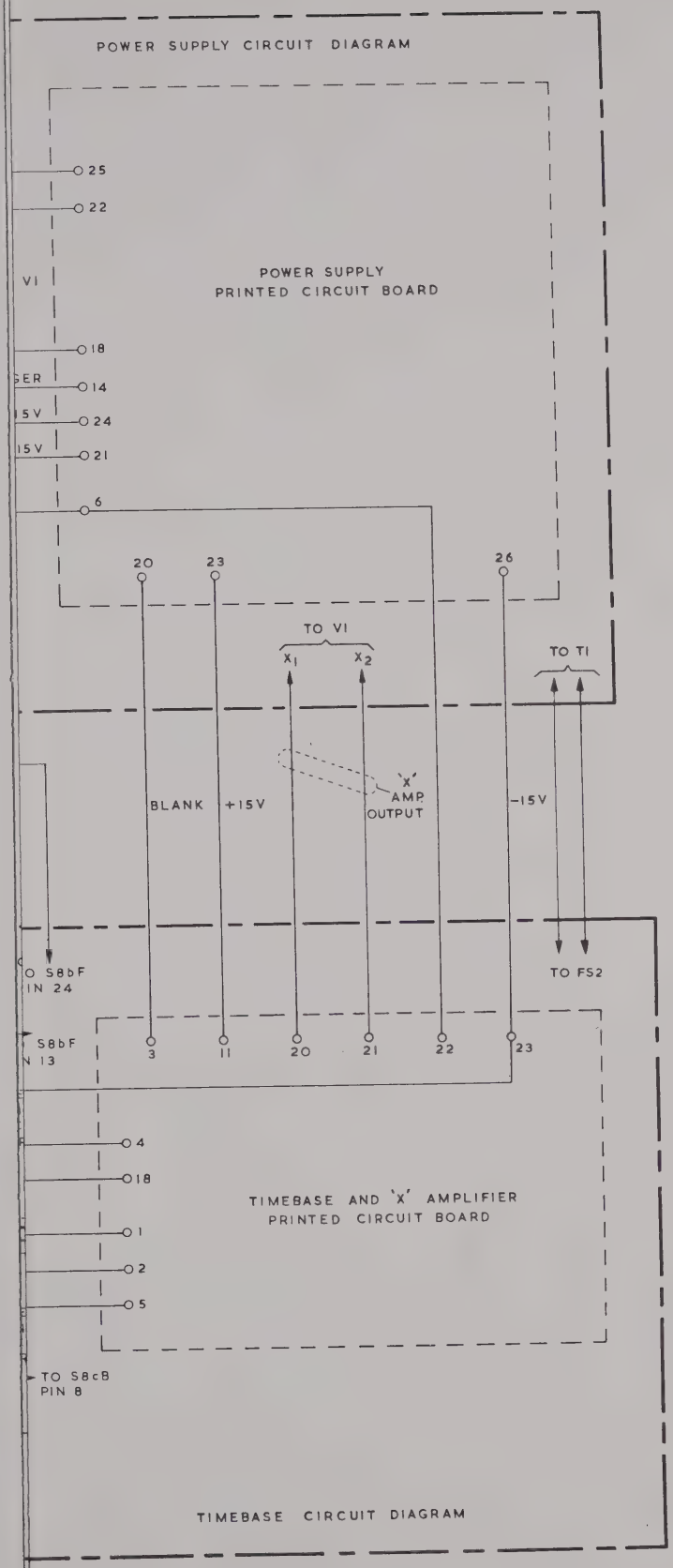


Figure 10. Interconnection of Printed Circuit Boards

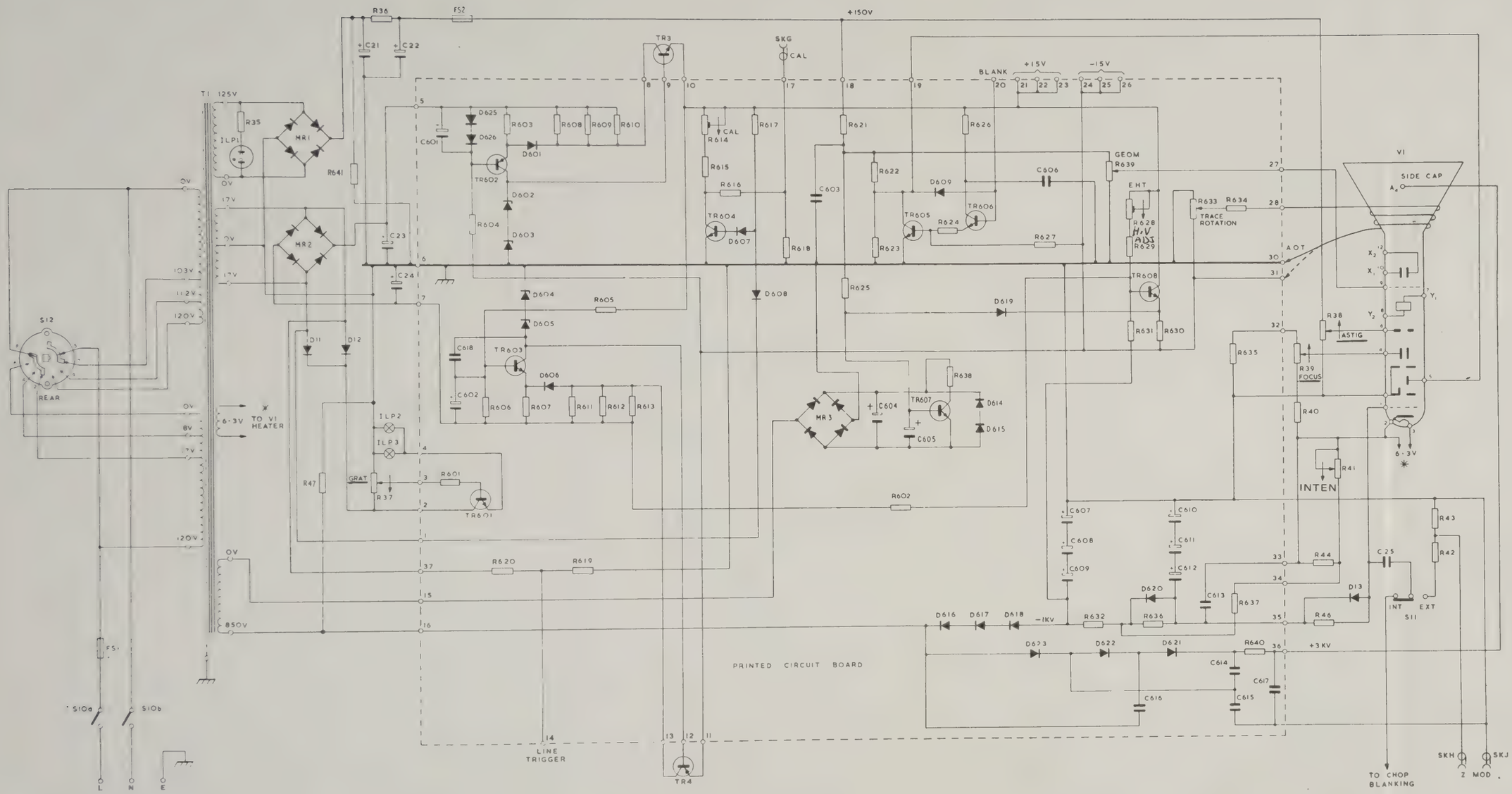


Figure 9. Power Supplies and CRT Circuit

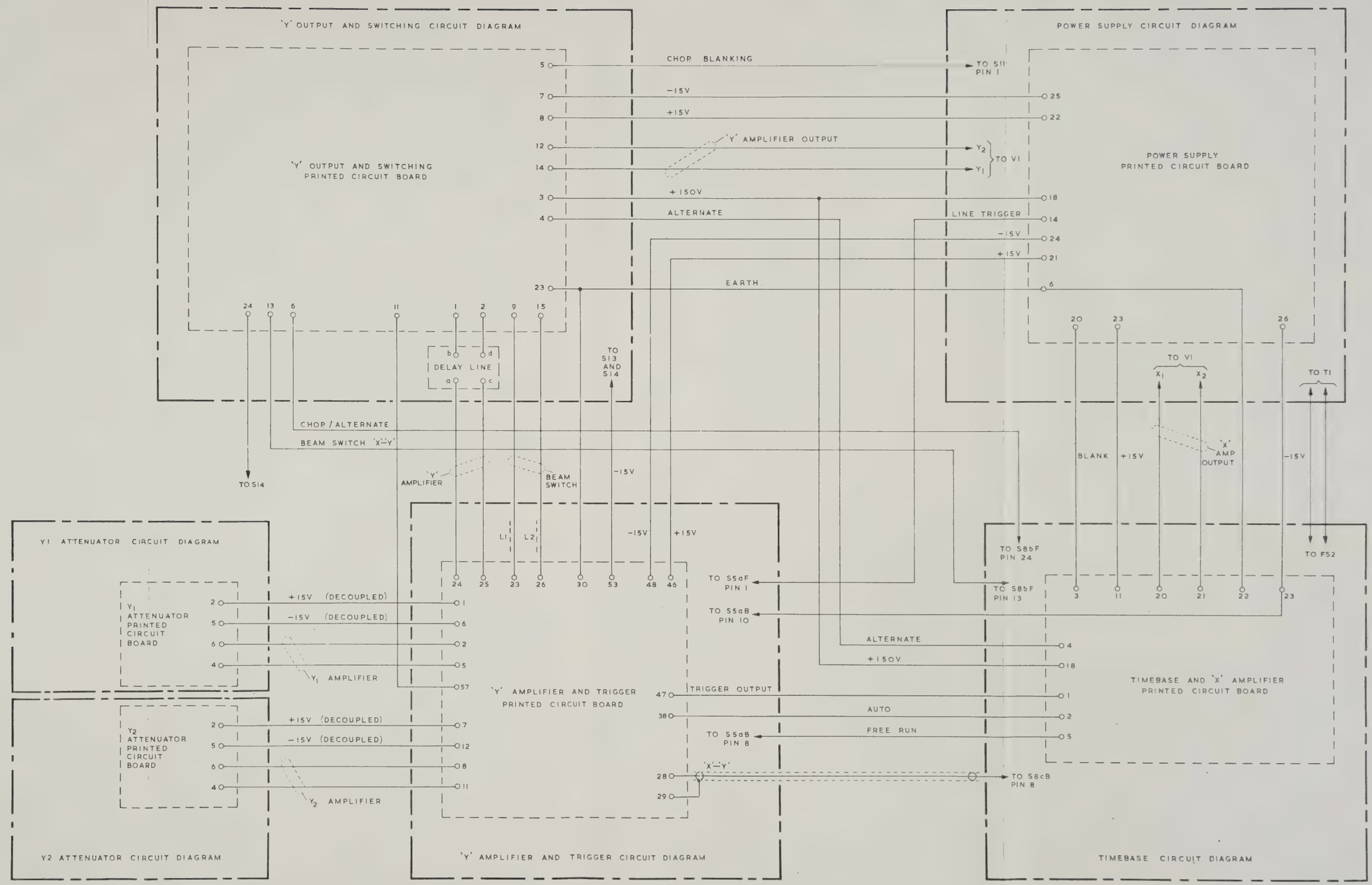


Figure 10. Interconnection of Printed Circuit Boards

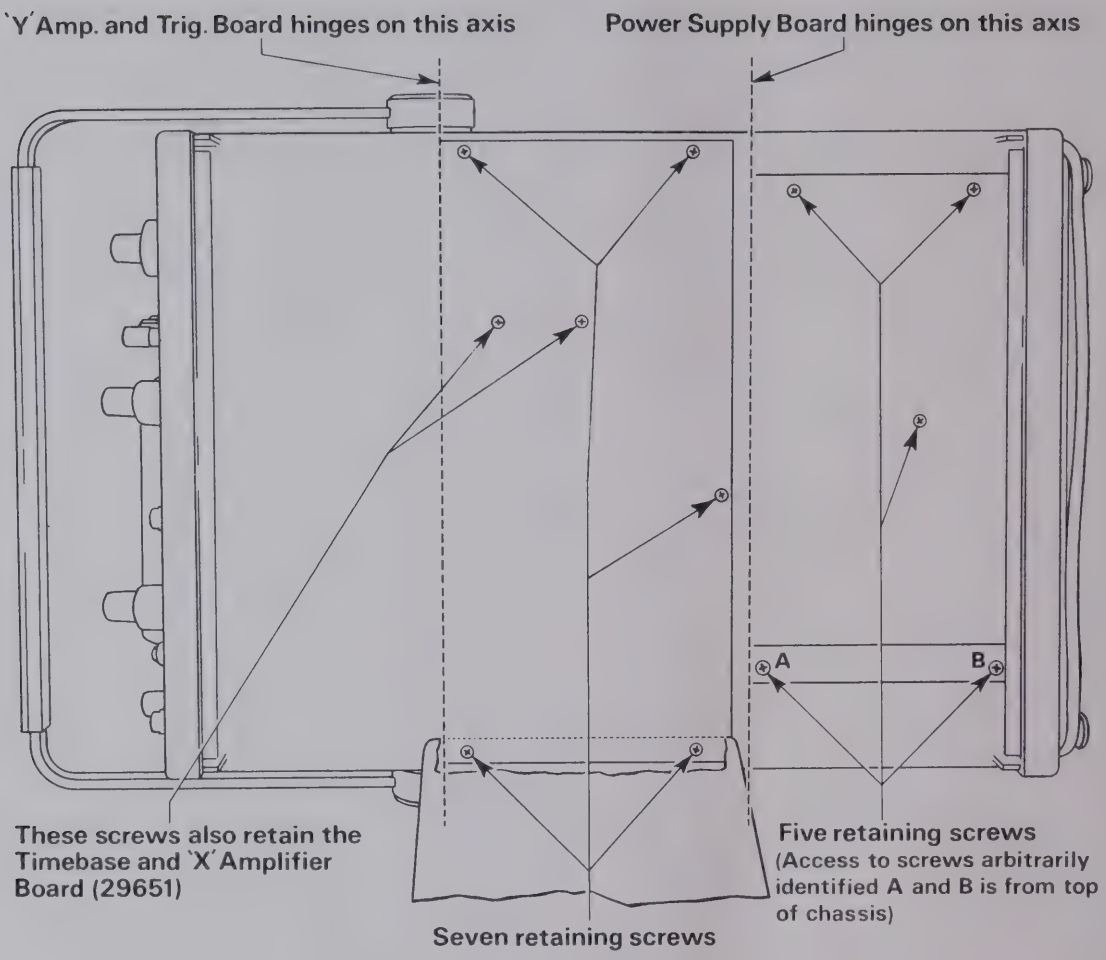

'Y' Amp. and Trig. Board hinges on this axis
Power Supply Board hinges on this axis
A
B
These screws also retain the Timebase and 'X' Amplifier Board (29651)
Five retaining screws
(Access to screws arbitrarily identified A and B is from top of chassis)
Seven retaining screws

Figure 11. Board Retaining Screws

STANDARDS LABORATORY EQUIPMENT AND MAINTENANCE OF CALIBRATION ACCURACY

NO.	INSTRUMENTS CAPABILITY VOLTAGE	FREQUENCY	ACCURACY	NO. OF INSTR.	INSTRUMENT TYPE	MAKE	SERIAL NO.	CALIBRATED BY	CALIBRATION PERIOD	REMARKS
1	1V	DC	0.01%	6	WESTON STANDARD CELL	WESTON	SEVERAL	WESTON	1 YEAR	
2	10mV-1.5V	DC	0.005%	1	TYPE K3 POTENTIOMETER	L & N	1607496	L & N	1 YEAR	
3	1V-750V	DC	0.04%	1	VOLT BOX	L & N	1200537	L & N	3 YEARS	
4	0.5V-500V	20cps-50kc	0.02%	2	TRANSFER VOLTMETER	BALLANTINE	D-1094-12	N B S	1 YEAR	
5	0.5V-100V	20cps-10MC	0.1%	1(A)	HF TRANSFER VM. MODEL 393	BALLANTINE	NO. 18	N B S	1 YEAR	(A) WITH TWO SETS OF PROBES
	0.5V-100V	20cps-30MC	0.5%					N B S	1 YEAR	
6	10μV-0.5V	DC-700MC	1% (B)		MICROPOT. MODEL 440	BALLANTINE	SET	N B S	1 YEAR	(B) + N B S CAL. ERROR
7	1V-300V	10MC-1000MC	1% (B)	1	AT VOLTMETER MODEL 390	BALLANTINE		N B S	1 YEAR	
8	10Ω	RESISTOR	0.002%	1	STANDARD RESISTOR	L & N	781347	N B S	3 YEARS	
9	100Ω	RESISTOR	0.002%	1	STANDARD RESISTOR	L & N	781335	N B S	3 YEARS	
10	1000Ω	RESISTOR	0.005%	1	STANDARD RESISTOR	CAMBRIDGE	L-251713	N B S	3 YEARS	

MAINTENANCE OF CALIBRATION ACCURACY

INST.	REFERENCE STANDARDS		
1, 2, 3	DC	10mV-750V	0.01-0.04%
2, 4	20cps-50kc	0.5V-500V	0.03%
2, 5	20cps-10MC	0.5V-100V	0.1%
2, 5	DC-30MC	0.5V-100V	0.5%
6	DC-700MC	10μV-0.5V	1% + N B S
7	10MC-1000MC	1V-300V	1% + N B S

WORKING STANDARDS

1kc TRANSFER VM BALLANTINE, D1094
HF TRANSFER VM BALLANTINE, MODEL 393
MICROPOTENTIOMETERS BALLANTINE 440
RATIO TRANSFORMERS, GERTSCH

CALIBRATION CONSOLE 100cps-100kc FOR 0.25% ACCURACY INSTRUMENTS

LEVEL CHECK – DAILY
ATTENUATOR CHECK – 6 MONTH
DISTORTION CHECK – 1 MONTH
FREQUENCY RESPONSE CHECK – 3 MONTH
GROUND CURRENT CHECK – 3 MONTH

CALIBRATION CONSOLES 2cps-20MC FOR 1%-3% ACCURACY INSTRUMENTS

LEVEL CHECK – 1 WEEK
ATTENUATOR CHECK – 6 MONTH
DISTORTION CHECK – 3 MONTH
FREQUENCY RESPONSE CHECK – 3 MONTH
GROUND CURRENT CHECK – 3 MONTH

CROSSCHECK CONSOLE 2-20MC FOR 1%-3% ACCURACY INSTRUMENTS

LEVEL CHECK – 1 WEEK
ATTENUATOR CHECK – 6 MONTH
DISTORTION CHECK – 3 MONTH
FREQUENCY RESPONSE CHECK – 3 MONTH
GROUND CURRENT CHECK – 3 MONTH

DAILY CROSSCHECK BETWEEN THE CONSOLES

BALLANTINE LABORATORIES, INC.
BOONTON, N. J.

DB-1050A WCR

CERTIFICATION OF TRACEABILITY TO NATIONAL BUREAU OF STANDARDS

This certification is prepared for use with Order No. 39591

from Hammond Organ Company, date August 21, 1973

Instruments covered: Model 1066B Serial # 020-0111

Ballantine Laboratories, Inc. hereby certifies that the calibrations of the instruments supplied on the above purchase order are traceable to the United States National Bureau of Standards.

As shown on the attached exhibit, calibrations are based on reference standards maintained by Ballantine Laboratories, Inc. Reference standards No. 1, 2 and 3 are recalibrated and certified traceable to NBS by the manufacturer at periodic intervals. All other reference standards are recalibrated and certified directly by NBS at periodic intervals. Records of all certifications are maintained in the Standards Laboratory of Ballantine Laboratories, Inc. and can be inspected on request.

By Edward Cahalan

Date August 28, 1973

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